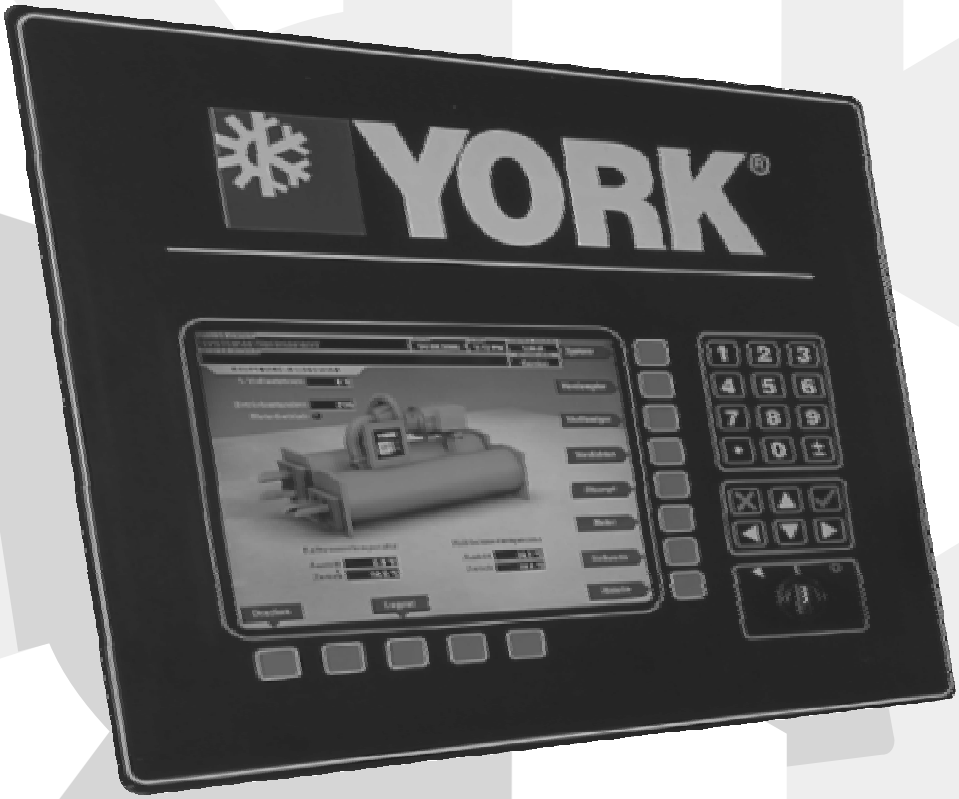
YK CENTRIFUGAL LIQUID CHILLER

OptiView Control Panel

OPERATION INSTRUCTION



CE

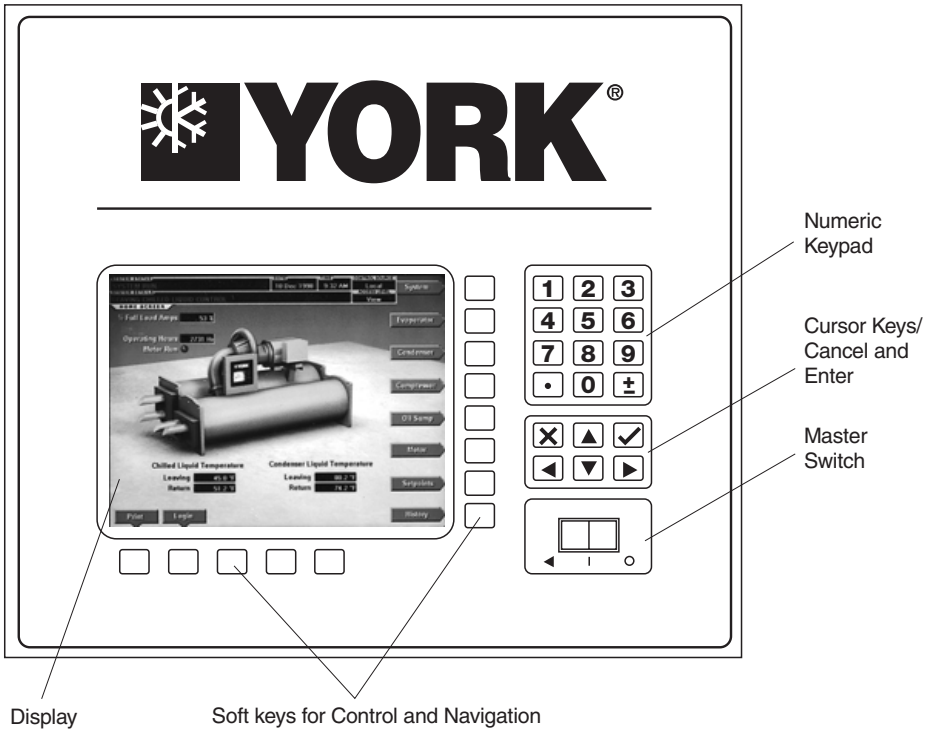
YORK® INTERNATIONAL

Effective from 11/00

GB

Contents

OptiView Control Panel



The YORK OptiView Control Panel (Graphic Control Centre) is a microprocessor based control system for YK centrifugal chillers. It controls the leaving chilled liquid temperature via pre-rotation vane (PRV) controls and has the ability to limit motor current via control of the PRV. It is compatible with electro-mechanical starter, optional YORK Solid State Starter (SSS) and optional Variable Speed Drive (VSD) applications.

The panel has a full screen LCD graphic display with a keypad interface. The graphic display allows the presentation of several operating parameters at once. In addition, the operator may view a graphical representation of the historical operation of the unit as well as the present operation.

For ease of use the locations of displayed parameters are clearly and intuitively marked and instructions for specific operations are provided on many of the screens. Information can be displayed in both metric (SI - temperatures in °C and pressures in kPa) or English (Imperial - temperatures in °F and pressures in PSIG) units in a number of languages.

The control panel also displays the unit operation using status and warning messages and records the cause of any shutdowns (Safety, Cycling or Normal). This information is stored in battery backed for viewing.

Information on the display falls into three distinct groups: Display Only, Programmable, and Navigation. The Programmable values and Navigation commands are subject to access level control.

Display Only information is read-only parameters about unit operation. This information may be represented by a numerical value, a text string, or an LED image. For numerical values, if the monitored parameter is above the normal operating range, the high limit value will be displayed along with the '>' symbol; if it is below the normal operating range, the low limit value will be displayed along with the '<' symbol. In some cases, the value may be rendered invalid by other conditions and the display will use X's to indicate this.

Programmable information can be changed by the operator/service technician to program system settings, the operator/service technician must be logged in with the appropriate access level.

Navigation allows movement between the different screens.

Access Level Three access levels are available:

View

This is the default access level (available automatically when power is applied to the unit) allowing navigation of the screens and access to display only information.

Operator

This access level is entered using the 'LOGIN' button on the 'HOME SCREEN'. A User ID and Password have to be entered using the numeric keypad. 'OPERATOR' access automatically reverts to the 'VIEW' after 10 minutes without a key-press. The 'OPERATOR' access level allows navigation of the screens, access to display only information and programming of a number of system settings.

'OPERATOR' access level can also be entered directly from the 'SETPOINTS SCREEN' without returning to the 'HOME SCREEN'.

Service

'SERVICE' access level is for qualified service personnel only.

The 'soft' keys surrounding the display are redefined based on the currently displayed screen. The buttons on the right side and base of the panel are used for navigation and selection of parameters. The keypad is used for data entry with a standard numeric keypad provided for entry of system setpoints and limits.

The Decimal key provides accurate entry of setpoint values.

The +/- key allows entry of negative values and AM/PM selection during time entry.

The ' ✓ ' (Check) key is provided as a universal 'Enter' or 'Accept'' key to confirm changes made.

The ' **X** ' key is provided as a universal 'Cancel' key to reject changes made.

Cursor Arrow keys (◀ ▶ ▲ ▼ are provided to allow movement on screens which contain a large amount of entry data. In addition, these keys can be used to scroll through history and event logs.

Setpoint Programming

Setpoint values are used to control the unit and devices connected to the system. Setpoints can be numeric values (such as 7°C for the Leaving Chilled Liquid Temperature), or an Enable or Disable function. The following procedure applies when programming setpoints:

- Press the desired setpoint key and a dialogue box appears displaying the present value, the upper and lower limits of the programmable range, and the default value.
- When the dialogue box begins with the word 'ENTER', the numeric keys should be used to enter the desired value. Leading zeroes are not necessary. If a decimal point is necessary, press the ' ' key.

Pressing the ▲ key, sets the entry value to the default for that setpoint. Pressing the ▼ key, clears the present entry. The ◀ key is a backspace key and causes the entry point to move back one space.

- If the dialogue box begins with 'SELECT', use the ◀ and ▶ keys to select the desired value.

If the previously defined setpoint is correct, press the ' **X** ' (Cancel) key to dismiss the dialogue box.

- Press the ' ✓ ' (Enter) key.

If the value is within range, it is accepted and the dialogue box disappears. The unit will begin to operate based on the new programmed value. If out of range, the value will not be accepted and the user is prompted to try again.

Master Switch

The three-position rocker switch is the master control. When toggled right, it is in the 'STOP/RESET' position, the middle position is 'RUN' and when momentarily toggled left it is in the 'START' position.

In the 'STOP/RESET' position the unit will not run under any condition, this enables maintenance and other tasks to be completed safely. In addition, the switch must be placed in this position following certain shutdowns before the unit is allowed to restart. This guarantees that manual intervention has taken place and the shutdown has been acknowledged.

The 'START' position is used to locally start the unit. When set to this position with no fault conditions, the unit will enter the system pre-lube (start sequence).

In the 'RUN' position the unit will operate normally and automatically restart following cycling shutdowns. The switch must be in this position to receive a valid remote start signal when operating from a remote control source.

Remote Control

The control panel expands the capabilities of remote control and communications. By providing a common networking protocol through the ISN, YORK units can be standalone or part of a group.

This new protocol allows increased remote control of the unit, as well as 24-hour performance monitoring via a remote site. In addition, compatibility is maintained with the present network of ISN communications.

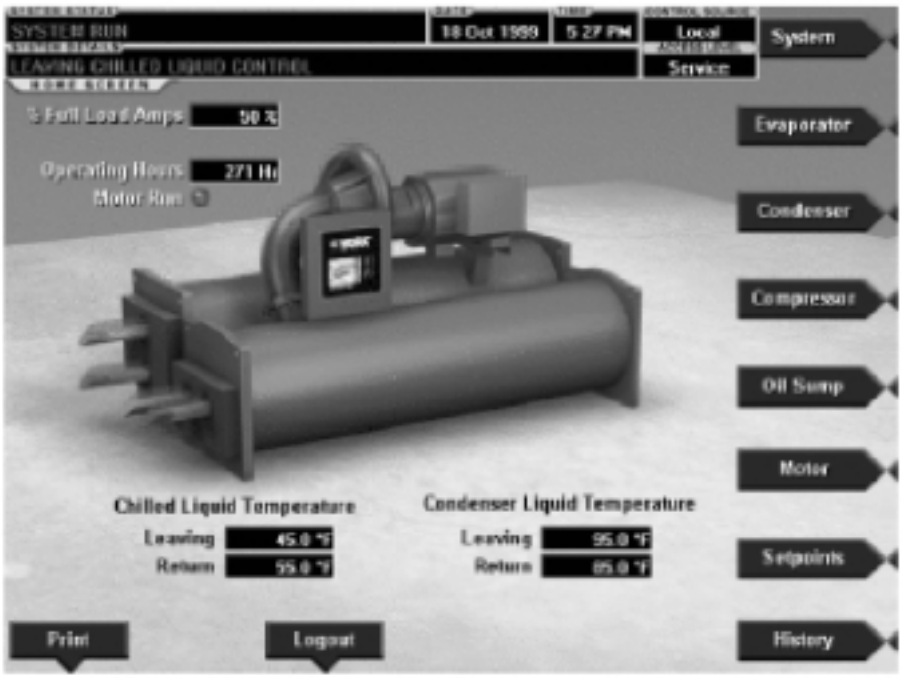
The unit also maintains the standard digital remote capabilities as well. Both of these remote control capabilities allow for the standard Energy Management System (EMS) interface:

- Remote Start; Remote Stop and Remote Ready to Start contacts.
- Remote Leaving Chilled Liquid Temperature Setpoint and Remote Current Limit Setpoint adjustment (0-10VDC, 2-10VDC, 0-20mA or 4-20mA) or Pulse Width Modulation.
- Cycling and Safety Shutdown Contacts

There are certain displayed values, programmable setpoints and controls shown in this manual that are for Service Technician use only. These are only displayed when logged in at SERVICE access level or higher. The setpoints and parameters displayed on these screens are explained in detail in manual 160.54-M1.

These parameters affect unit operation and should NEVER be modified by anyone other than a qualified Service Technician.

1 HOME SCREEN



The 'HOME SCREEN' is displayed by default (at the 'VIEW ACCESS LEVEL') when the unit is powered on. This screen shows the main operating values, enables system access and permits further navigation to the sub screens.

The **Login/Logout** key is used to enter/exit the 'OPERATOR' and 'SERVICE' 'ACCESS LEVEL' from the 'VIEW ACCESS LEVEL'

The **Print** key should be used to obtain a hard-copy print of the current system status.

The **Warning Reset** key is used at 'OPERATOR/SERVICE ACCESS LEVEL' to acknowledge and reset 'WARNING' messages (displayed in yellow), refer to Section 10 for details of display messages and their meaning.

The **Message Clear** key is used at 'SERVICE ACCESS LEVEL' to clear 'SAFETY' or 'CYCLING' shutdown messages (displayed in red and orange), refer to Section 10 for details of display messages and their meaning.

System key (see Section 2)

Evaporator key (see Section 3)

Condenser key (see Section 4)

Compressor key (see Section 5)

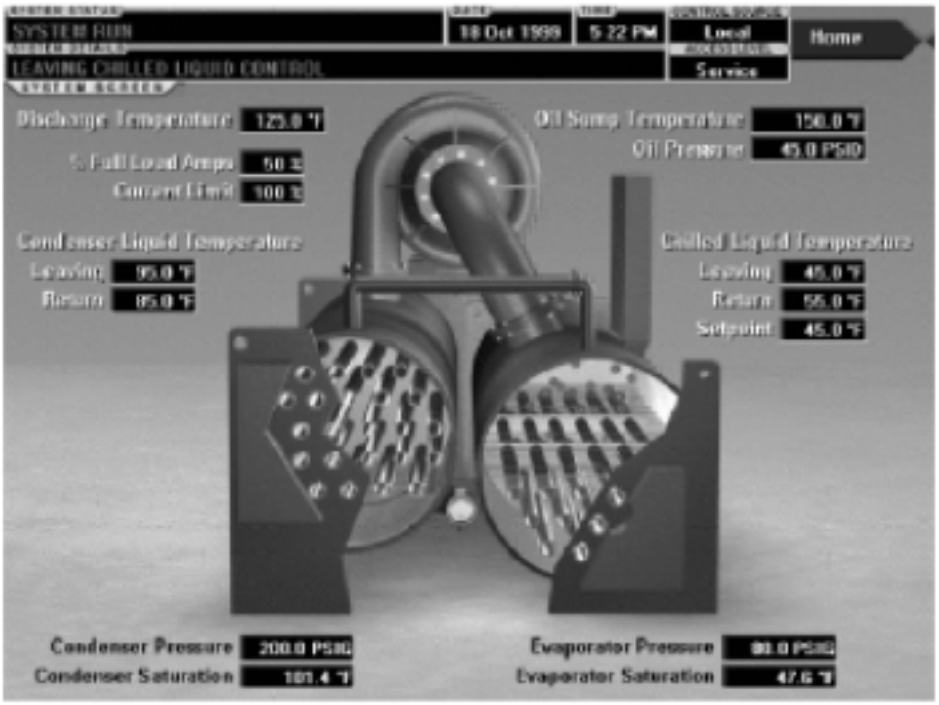
Oil Sump key (see Section 6)

Motor key (see Section 7)

Setpoints key (see Section 8)

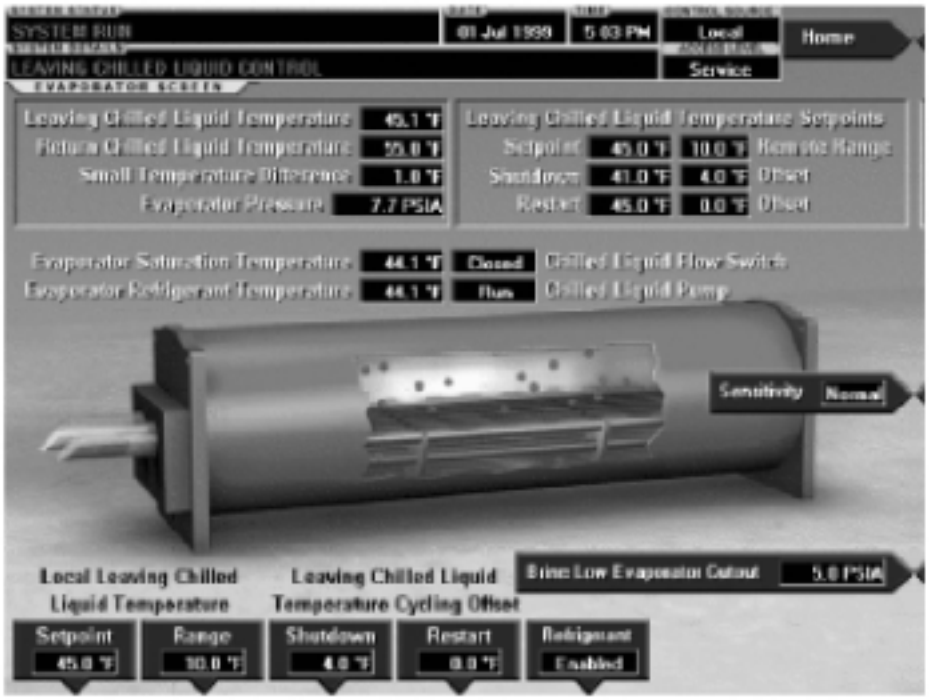
History key (see Section 9)

2 SYSTEM SCREEN



The 'SYSTEM SCREEN' displays pressures and temperatures for the evaporator, condenser, compressor and oil system. Electrical load and current limit are also shown.

3 EVAPORATOR SCREEN



The 'EVAPORATOR SCREEN' displays a cutaway view of the unit evaporator showing current operating temperatures and pressures, status of the flow switch and liquid pump signal and the control setpoints.

The local leaving chilled liquid temperature 'SETPOINT' and 'RANGE', and leaving chilled liquid temperature cycling offset 'SHUTDOWN' and 'RESTART' values are also programmed on this screen:

Setpoint

Defines the leaving chilled liquid temperature that is to be maintained by the unit. The 'SETPOINT' can be programmed between 3.3°C (38°F) and 21.1°C (70°F) for water cooling applications or -12.2°C (10°F) and 21.1°C (70°F) for brine/glycol applications.

NOTE

When Smart Freeze has been enabled by a qualified Service Technician, the programmable 'SETPOINT' is 2.2°C (36°F) to 21.1°C (70°F) for water cooling applications.

Range

The programmed 'SETPOINT' can be reset (offset) upwards by an analogue signal: (0-20 mA, 4-20 mA, 0-10 Vdc or 2-10 Vdc) in the analogue remote mode, or PWM signal in digital remote mode. The offset ('RANGE') may be programmed to 5.6°C (10°F) or 11.1°C (20°F) (11.1°C is the default 'RANGE').

For example, if the 'SETPOINT' is programmed for 7°C and the programmed 'RANGE' is 5.6°C, then the remote device can set the leaving chilled liquid temperature setpoint over the range 7°C to 12.6°C.

NOTE

Additionally, a remote GPIC device (in ISN remote mode) can define the setpoint through a serial data stream

Cycling Offset - Shutdown

Defines the leaving chilled liquid temperature at which the unit will shutdown on a 'LEAVING CHILLED LIQUID - LOW TEMPERATURE'. The 'OFFSET' (below 'SETPOINT') can be programmed between 0.56°C (1°F) and 35.6°C (64°F) to a minimum cut-out of 2.2°C (36°F) for water cooling applications (1.1°C (34°F) with Smart Freeze enabled) or -14.4°C (6°F) for brine/glycol applications.

When the programmed leaving chilled liquid temperature 'SETPOINT' is changed, the shutdown is fixed at of 2.2°C (36°F) for water cooling applications (1.1°C (34°F) with Smart Freeze enabled) or -14.4°C (6°F) for brine/glycol applications for the next ten minutes.

The shutdown will then revert to the 'SETPOINT' plus the 'OFFSET' after ten minutes has elapsed.

Cycling Offset - Restart

Defines the leaving chilled liquid temperature at which the unit will restart after a 'LEAVING CHILLED LIQUID - LOW TEMPERATURE ' shutdown. The 'OFFSET' (above 'SETPOINT') can be programmed between 0°C (0°F) and 21.1°C (70°F) to a maximum restart of 26.7°C (80°F). This 'OFFSET' can be used to reduce unit cycling by delaying the restart until the cooling load has increased dramatically.

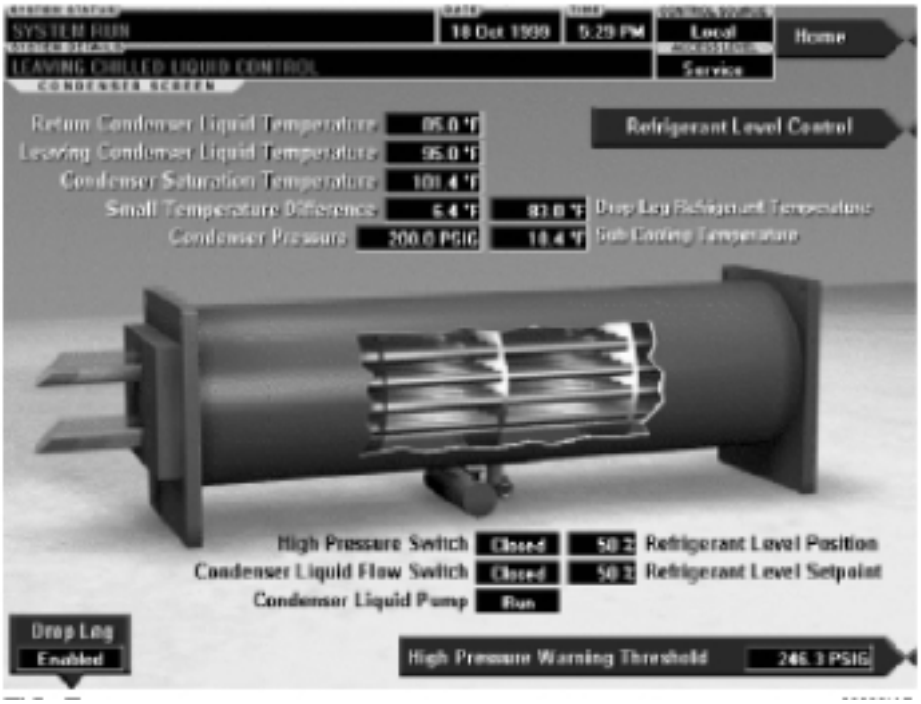
Refrigerant - Service Technicians

Sensitivity - Service Technicians

Brine Low Evaporator Cutout - Service Technicians

Smart Freeze - Service Technicians

4 CONDENSER SCREEN



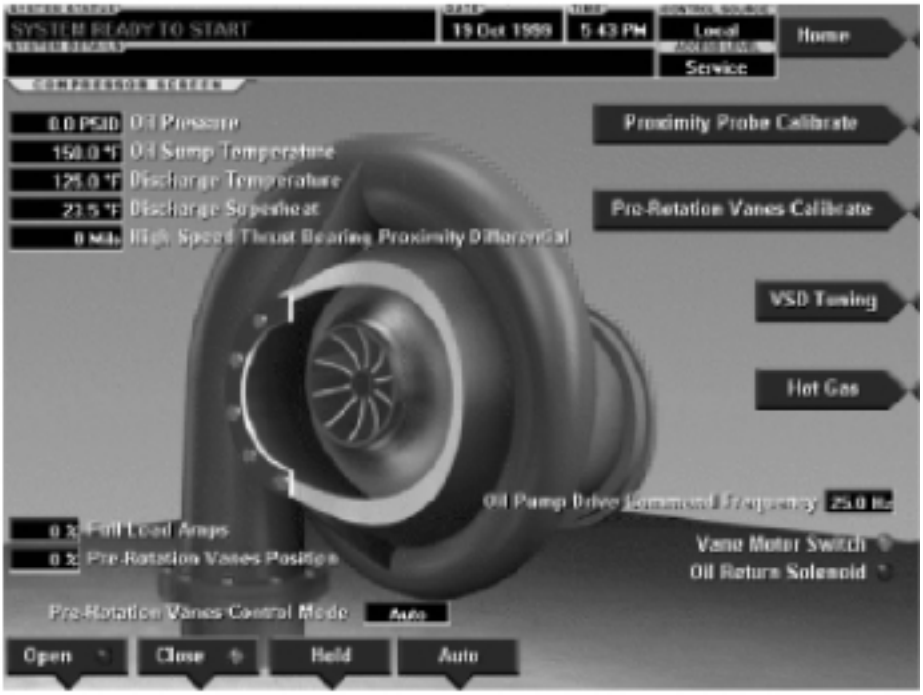
The 'CONDENSER SCREEN' displays a cutaway view of the unit condenser showing current operating temperatures and pressures, status of the high pressure and flow switches and cooling liquid pump signal and the refrigerant level position and setpoint.

Refrigerant Level Control - Service Technicians

High Pressure Warning Threshold - Service Technicians

Drop Leg - Service Technicians

5 COMPRESSOR SCREEN



The 'COMPRESSOR SCREEN' displays a cutaway view of the unit compressor showing current operating temperatures and pressures and status of the switches and solenoids.

Proximity Probe Calibration - Service Technicians

Pre-Rotation Vanes Calibrate - Service Technicians

VSD Tuning - Service Technicians

Hot Gas - Service Technicians

Pre-Rotation Vanes Control (Open, Close, Hold and Auto) - Service Technicians

6 OIL SUMP SCREEN

The 'OIL SUMP SCREEN' displays the unit oil sump showing current operating temperatures and pressures and status of the oil pump run signal and solenoid. The screen will also provide data for the variable speed oil pump (VSOP) when fitted.

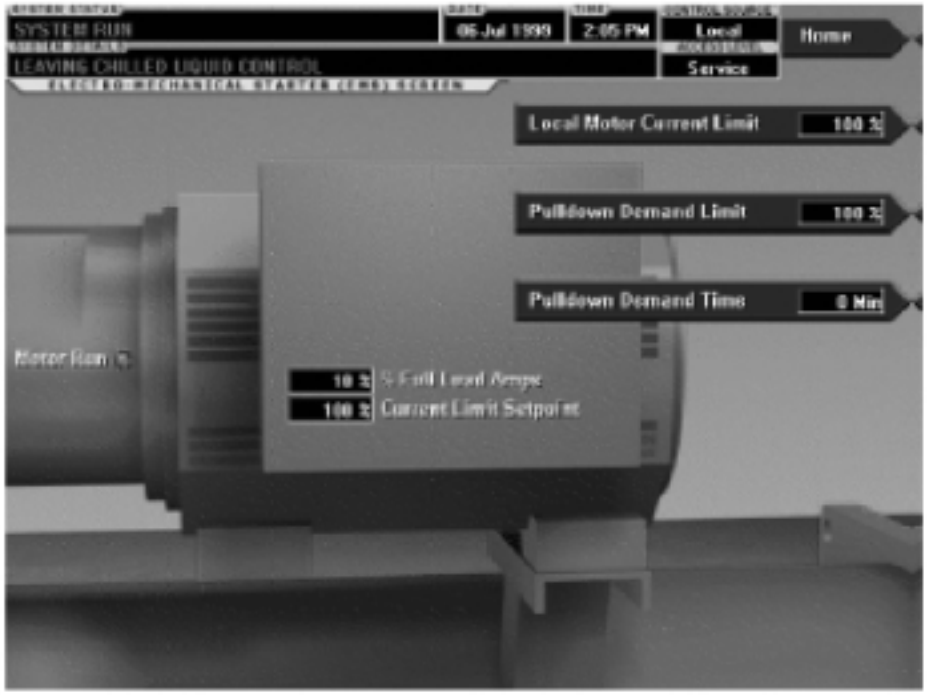
Standby Lube (VSOP) - Service Technicians

Pressure Setpoint (VSOP) - Service Technicians

Variable Speed Oil Pump Control (Raise, Lower, Set and Auto) - Service Technicians

7 MOTOR SCREENS

7.1 EM STARTER SCREEN



The 'EM STARTER SCREEN' shows the motor current as a percentage of full load amps (FLA), the current limit setpoint (set locally (refer to 'LOCAL MOTOR CURRENT LIMIT') or remotely by an analogue signal: (0-20 mA, 4-20 mA, 0-10 Vdc or 2-10 Vdc) in the analogue remote mode, or PWM signal in digital remote mode or via the ISN/GPIC interface in the ISN mode) and the pulldown demand time remaining, when pulldown demand limiting is active.

The 'LOCAL MOTOR CURRENT LIMIT' and 'PULLDOWN DEMAND LIMIT' and 'TIME' are also programmed on this screen:

Local Motor Current Limit

Defines the maximum allowable motor current during operation as a percentage of FLA. When the motor current reaches or exceeds the programmed limit the PRV are prohibited from opening or closed to reduce the motor current.

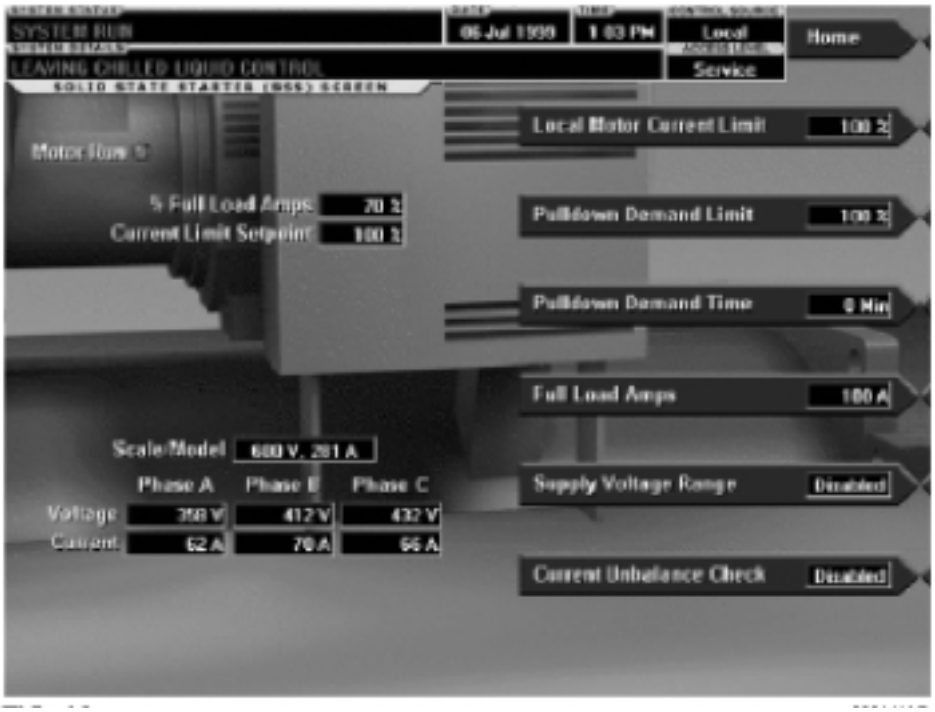
Pulldown Demand Limit

Defines the maximum allowable motor current during pulldown demand limiting at unit startup as a percentage of FLA. This value overrides the 'LOCAL MOTOR CURRENT LIMIT' for the time specified in the motor current 'PULLDOWN DEMAND TIME'.

Pulldown Demand Time

Specifies the period of time that pulldown demand limiting will be active during unit startup.

7.2 SOLID STATE STARTER SCREEN



The 'SOLID STATE STARTER SCREEN' shows the motor current as a percentage of full load amps (FLA), the current limit setpoint (set locally (refer to 'LOCAL MOTOR CURRENT LIMIT') or remotely by an analogue signal: (0-20 mA, 4-20 mA, 0-10 Vdc or 2-10 Vdc) in the analogue remote mode, or PWM signal in digital remote mode or via the ISN/GPIC interface in the ISN mode), details of the SSS rating and operating voltage and current per phase and the pulldown demand time remaining, when pulldown demand limiting is active.

The 'LOCAL MOTOR CURRENT LIMIT' and 'PULLDOWN DEMAND LIMIT' and 'TIME' are also programmed on this screen:

Local Motor Current Limit

Defines the maximum allowable motor current during operation as a percentage of FLA. When the motor current reaches or exceeds the programmed limit the PRV are prohibited from opening or closed to reduce the motor current.

Pulldown Demand Limit

Defines the maximum allowable motor current during pulldown demand limiting at unit startup as a percentage of FLA. This value overrides the 'LOCAL MOTOR CURRENT LIMIT' for the time specified in the motor current 'PULLDOWN DEMAND TIME'.

Pulldown Demand Time

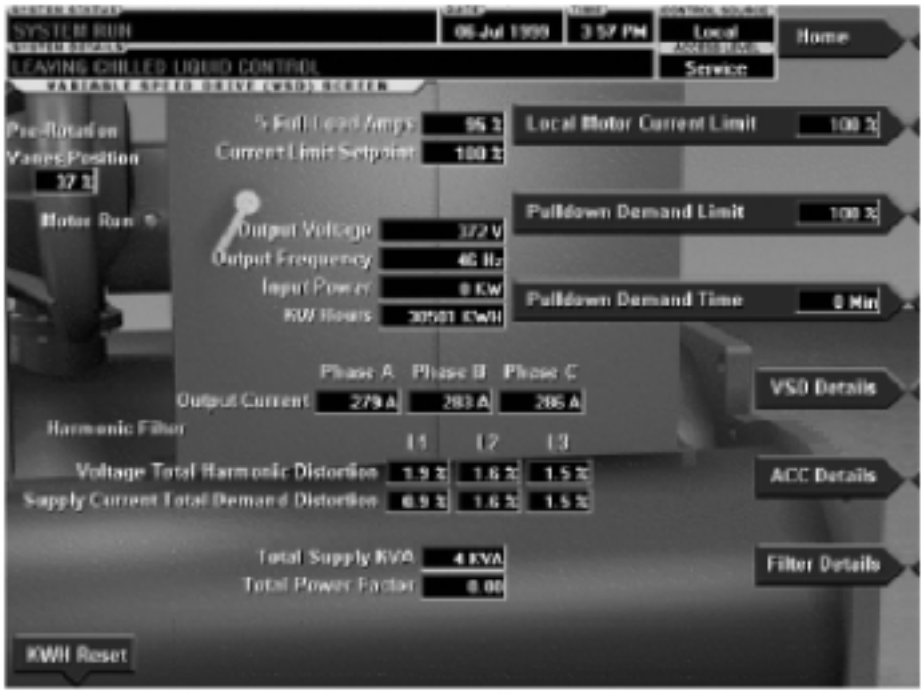
Specifies the period of time that pulldown demand limiting will be active during unit startup.

Full Load Amps - Service Technicians

Supply Voltage Range - Service Technicians

Current Unbalance Check - Service Technicians

7.3 VSD SCREEN



The 'VSD SCREEN' shows the motor current as a percentage of full load amps (FLA), the current limit setpoint (set locally (refer to 'LOCAL MOTOR CURRENT LIMIT') or remotely by an analogue signal: (0-20 mA, 4-20 mA, 0-10 Vdc or 2-10 Vdc) in the analogue remote mode, or PWM signal in digital remote mode or via the ISN/GPIC interface in the ISN mode) and the pulldown demand time remaining, when pulldown demand limiting is active.

The screen also displays the output voltage, frequency and phase current to the motor, total and cumulative input Kilowatts and PRV position. In addition, supply kVA, power factor and voltage and current total harmonic distortion are shown on models with harmonic filters.

The 'LOCAL MOTOR CURRENT LIMIT' and 'PULLDOWN DEMAND LIMIT' and 'TIME' are also programmed on this screen:

Local Motor Current Limit

Defines the maximum allowable motor current during operation as a percentage of FLA. When the motor current reaches or exceeds the programmed limit the PRV are prohibited from opening or closed to reduce the motor current.

Pulldown Demand Limit

Defines the maximum allowable motor current during pulldown demand limiting at unit startup as a percentage of FLA. This value overrides the 'LOCAL MOTOR CURRENT LIMIT' for the time specified in the motor current 'PULLDOWN DEMAND TIME'.

Pulldown Demand Time

Specifies the period of time that pulldown demand limiting will be active during unit startup.

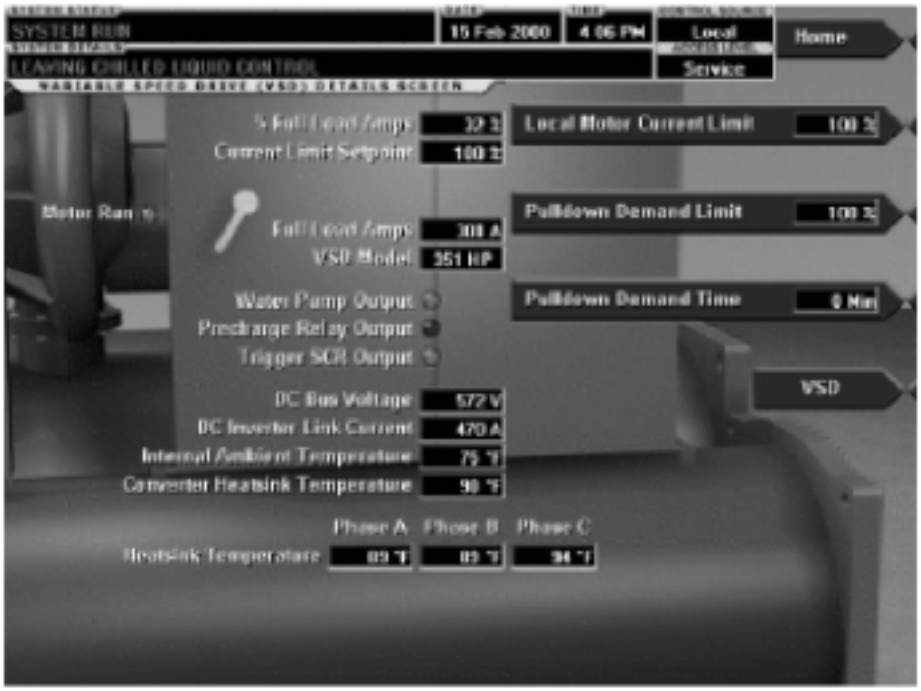
VSD Details - see Section 7.3.1

ACC Details - Service Technicians

Filter Inhibit and Filter Details - Units with Harmonic Filters

KWH Reset - Service Technicians

7.3.1 VSD DETAILS SCREEN



The 'VSD DETAILS SCREEN' repeats the motor current, current limit setpoint and the pulldown demand time remaining shown on the 'VSD SCREEN'.

The screen also displays the status of the water pump, precharge relay and trigger SCR outputs, DC bus voltage, DC inverter link current and internal ambient, convertor heatsink and phase A, B and C heatsink temperatures.

For details of programming the 'LOCAL MOTOR CURRENT LIMIT' and 'PULLDOWN DEMAND LIMIT' and 'TIME' refer to the 'VSD SCREEN'.

VSD (see Section 7.3)

8 SETPOINTS SCREEN

The 'SETPOINTS SCREEN' displays the current operating leaving chilled liquid temperature setpoint and remote range, low leaving chilled liquid temperature cycling shutdown and restart values and there offset and the current limit setpoint.

The local leaving chilled liquid temperature 'SETPOINT' and 'RANGE', low leaving chilled liquid temperature cycling 'SHUTDOWN' and 'RESTART' values, 'LOCAL MOTOR CURRENT LIMIT' and 'PULLDOWN DEMAND LIMIT' and 'TIME' and 'REMOTE ANALOGUE INPUT RANGE' should be programmed on this screen:

Setpoint

Defines the leaving chilled liquid temperature that is to be maintained by the unit. The 'SETPOINT' can be programmed between 3.3°C (38°F) and 21.1°C (70°F) for water cooling applications or -12.2°C (10°F) and 21.1°C (70°F) for brine/glycol applications.

NOTE

When Smart Freeze has been enabled by a qualified Service Technician, the programmable 'SETPOINT' is 2.2°C (36°F) to 21.1°C (70°F) for water cooling applications.

Range

The programmed 'SETPOINT' can be reset (offset) upwards by an analogue signal: (0-20 mA, 4-20 mA, 0-10 Vdc or 2-10 Vdc) in the analogue remote mode, or PWM signal in digital remote mode. The offset ('RANGE') may be programmed to 5.6°C (10°F) or 11.1°C (20°F) (11.1°C is the default 'RANGE').

For example, if the 'SETPOINT' is programmed for 7°C and the programmed 'RANGE' is 5.6°C, then the remote device can set the leaving chilled liquid temperature setpoint over the range 7°C to 12.6°C.

NOTE

Additionally, a remote GPIC device (in ISN remote mode) can define the setpoint through a serial data stream.

Cycling Offset - Shutdown

Defines the leaving chilled liquid temperature at which the unit will shutdown on a 'LEAVING CHILLED LIQUID - LOW TEMPERATURE'. The 'OFFSET' (below 'SETPOINT') can be programmed between 0.56°C (1°F) and 35.6°C (64°F) to a minimum cut-out of 2.2°C (36°F) for water cooling applications (1.1°C (34°F) with Smart Freeze enabled) or -14.4°C (6°F) for brine/glycol applications.

When the programmed leaving chilled liquid temperature 'SETPOINT' is changed, the shutdown is fixed at of 2.2°C (36°F) for water cooling applications (1.1°C (34°F) with Smart Freeze enabled) or -14.4°C (6°F) for brine/glycol applications for the next ten minutes.

The shutdown will then revert to the 'SETPOINT' plus the 'OFFSET' after ten minutes has elapsed.

Cycling Offset - Restart

Defines the leaving chilled liquid temperature at which the unit will restart after a 'LEAVING CHILLED LIQUID - LOW TEMPERATURE ' shutdown. The 'OFFSET' (above 'SETPOINT') can be programmed between 0°C (0°F) and 21.1°C (70°F) to a maximum restart of 26.7°C (80°F). This 'OFFSET' can be used to reduce unit cycling by delaying the restart until the cooling load has increased dramatically.

Local Motor Current Limit

Defines the maximum allowable motor current during operation as a percentage of FLA. When the motor current reaches or exceeds the programmed limit the PRV are prohibited from opening or closed to reduce the motor current.

Pulldown Demand Limit

Defines the maximum allowable motor current during pulldown demand limiting at unit startup as a percentage of FLA. This value overrides the 'LOCAL MOTOR CURRENT LIMIT' for the time specified in the motor current 'PULLDOWN DEMAND TIME'.

Pulldown Demand Time

Specifies the period of time that pulldown demand limiting will be active during unit startup.

Remote Analog Input Range
(Flash Memory Card version C.MLM.01.01 or later)

Defines the signal range applied for remote reset of the leaving 'Chilled Liquid Temperature Setpoint' and 'Current Limit Setpoint' in the analogue remote mode. The value should be programmed for 0-10Vdc if the remote signal is 0-10 Vdc or 0-20 mA. If the remote signal is 2-10 Vdc or 4-20 mA, the value must be programmed for 2-10 Vdc.

8.1 SETUP SCREEN

The 'SETUP SCREEN' displays general configuration parameters as set by the microprocessor board jumpers and program switches. In addition, it allows the real time clock to be enabled, setting of the time and date and specification of the time format:

Set Date

Used to specify the present date, the date is critical to logging system shutdowns accurately and for utilising the scheduling capabilities. The day, month and four-digit year (using leading zeroes as necessary) must be entered.

Set Time

Used to specify the present time, the time is critical to logging system shutdowns accurately and for utilising the scheduling capabilities. The hour and minute desired (using leading zeroes as necessary) must be entered. If the unit is in 24-hour mode, the time must be entered in the 24-hour format, otherwise AM or PM must be selected for the entered time.

Clock (Enabled / Disabled)

Used to enable or disable the real-time clock in order to conserve battery life. The clock must be enabled during commissioning. For prolonged shutdowns the clock should be disabled.

12/24 Hr

Used to specify the time format. 12-Hour time format includes AM and PM modifiers and shows time between 1:00 and 12:59, 24-Hour time format shows times between 0:00 and 23:59.

Schedule (see Section 8.1.1)

User (see Section 8.1.2)

Comms (see Section 8.1.3)

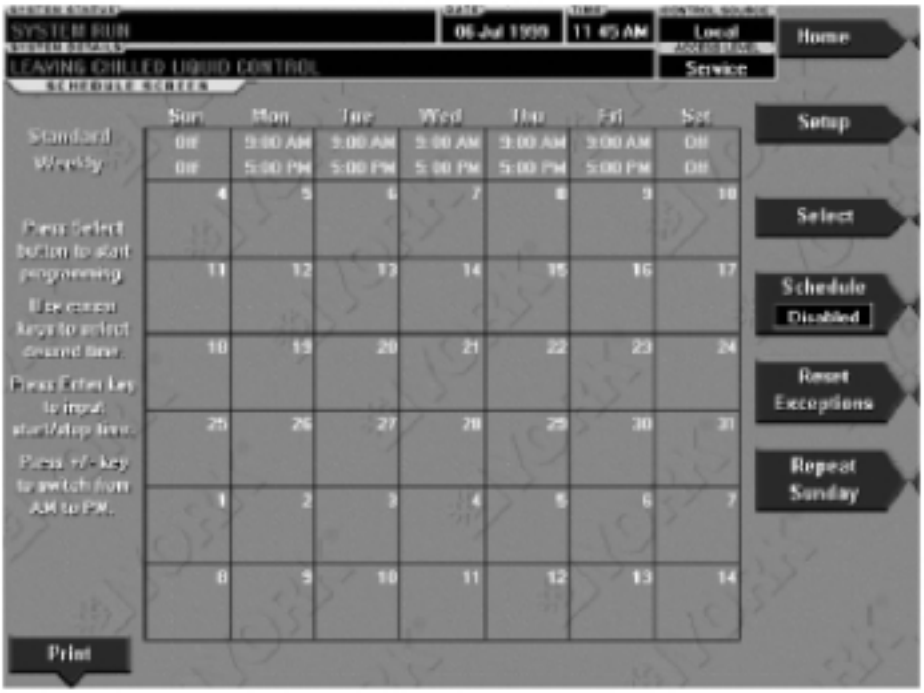
Printer (see Section 8.1.4)

Sales Order (see Section 8.1.5)

Operations (see Section 8.1.6)

Diagnostics - Service Technicians

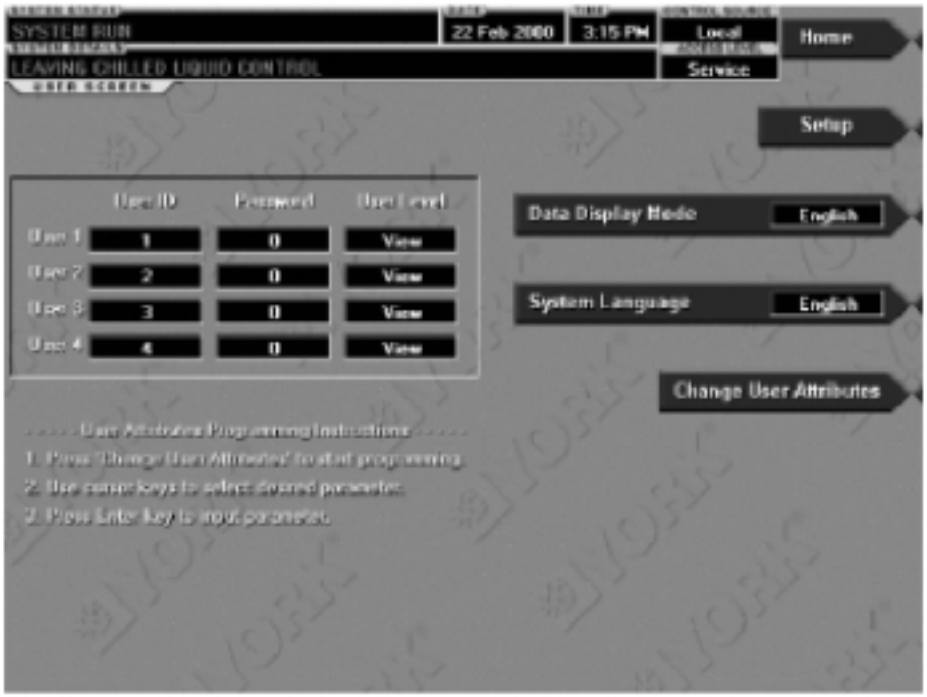
8.1.1 SCHEDULE SCREEN



When programming the 'SCHEDULE SCREEN' the Select button is used to enable the cursor arrows which are used to highlight the day and the start or stop times that are to be modified. The '✓' (Check) key is used to program the Start / Stop times for that day.

- For the Start / Stop schedule to function correctly each start time must have a corresponding stop time which occurs later in that day.
- The programmed schedule for a given day can be cancelled by setting both the Start time and Stop time to 12:00AM.
- If the start time equals the stop time (with any time other than 12:00AM), the unit is OFF for that day.
- If the unit is to operate continuously through several days, the stop time of Day 1 can be set to 11:59PM and the start time of Day 2 can be set to 12:00AM. The unit will not stop but continue to operate until the stop of Day 2.
- A standard set of start / stop times can be defined which are utilised every week. Exception Start / Stop combinations for any day of the week up to 6 weeks in advance are then specified. At the end of each week the schedule for the next week is created by combining the standard week definition and the next defined exception week. The schedule is then updated as each of the exception weeks "shifts down", leaving a new, blank exception week in the 6th week slot.

8.1.2 USER SCREEN



The 'USER SCREEN' is used to define User ID's and passwords for operator/service personnel. The Change button is used to enable the cursor arrows which are used to highlight the User ID, Password or User Level that is to be modified. The ' ✓ ' (Check) key is used to program the require value.

The Data Display Mode defines the unit system (English or Metric) used on the display and the System Language is selected by scrolling through the list of available languages and pressing the ▲ key.

NOTE

The selected language will not be displayed until another screen is selected.

8.1.3 COMMS SCREEN

The 'COMMS SCREEN' allows the unit ID to be set (for ISN Network use) and the printer and communications ports to be set-up (baud rate, data bits, parity and stop bits).

8.1.4 PRINTER SCREEN

The 'PRINTER SCREEN' allows the printer type to be programmed and automatic printer logging to be enabled at the start time and interval defined. The time remaining to the next log report will also be displayed.

The Print Report button allows selection and printing of a particular report type (status report, setpoints report, schedule report or sales order report). The Print All Histories button generates a report of system data at the time of all stored shutdowns.

8.1.5 SALES ORDER SCREEN

The 'SALES ORDER SCREEN' displays the sales order and name plate information for the unit programmed during manufacturing and commissioning.

8.1.6 OPERATIONS SCREEN

The 'OPERATIONS SCREEN' displays the run time since the last unit start and enables the control source to be selected (local, analogue remote, digital remote, modem remote or ISN remote.

9 HISTORY SCREEN

The 'HISTORY SCREEN' displays details of the last normal shutdown, last safety or cycling shutdown and a chronological listing of the last 10 safety or cycling shutdowns.

The View Details button displays a sub-screen of system parameters (see below) at the time of the selected shutdown.

The Print History button generates a report of a selected shutdown and the Print All Histories button generates a report of system data at the time of all stored shutdowns.

Trends - (see Section 9.1)

Custom View- (see Section 9.2)

9.1 TRENDS SCREEN

As many as six selected parameters can be plotted in an X/Y graph format using the start and stop buttons.

The X-Axis is scaled per the selected Data Collection Interval and displayed in a time of day or elapsed time format, as selected with the X-axis toggle key.

The Y-Axis is scaled for each parameter per the selected minimum and maximum value for each parameter. Analogue parameters are scaled in pressure, temperature, volts, amps, hertz or time. Digital on/off parameters are scaled as zero (off) and one (on).

Only one Y-Axis label is displayed at a time. The Y-Axis Toggle Key is used to toggle the Y-Axis labels through the different parameters. The Y-Axis label that is being displayed is identified at the top of the graph. All parameters are displayed simultaneously. For identification, each plotted parameter and associated Y-Axis labelling is colour co-ordinated.

The parameters are sampled at the selected Data Collection Interval and plotted using 450 data points across the X-Axis.

If the actual value of the sampled parameter is less than the Y-Axis label minimum for that parameter, the value will be plotted at the minimum value. Similarly, if the actual value is greater than the Y-Axis label maximum for that parameter, the value will be plotted at the maximum value.

There are two types of charts that can be created: ONE SCREEN or CONTINUOUS. When the plotting has reached the end of the X-Axis, one of the following will occur, depending on which is selected:

If ONE SCREEN has been selected, the trending stops and the data is frozen. If CONTINUOUS has been selected, the oldest data is dropped from the left-hand side of the graph at the next Data Collection Interval. Thereafter, the oldest data is dropped from left-hand side of the graph at each Data Collection Interval.

If a power failure occurs while the trending is running, the trending is stopped. Upon restoration of power, the last screen of data that was collected will be displayed on the trending screen. The START key must be pressed to initiate a new trend screen.

Trend-Setup - (see Section 9.1.1)

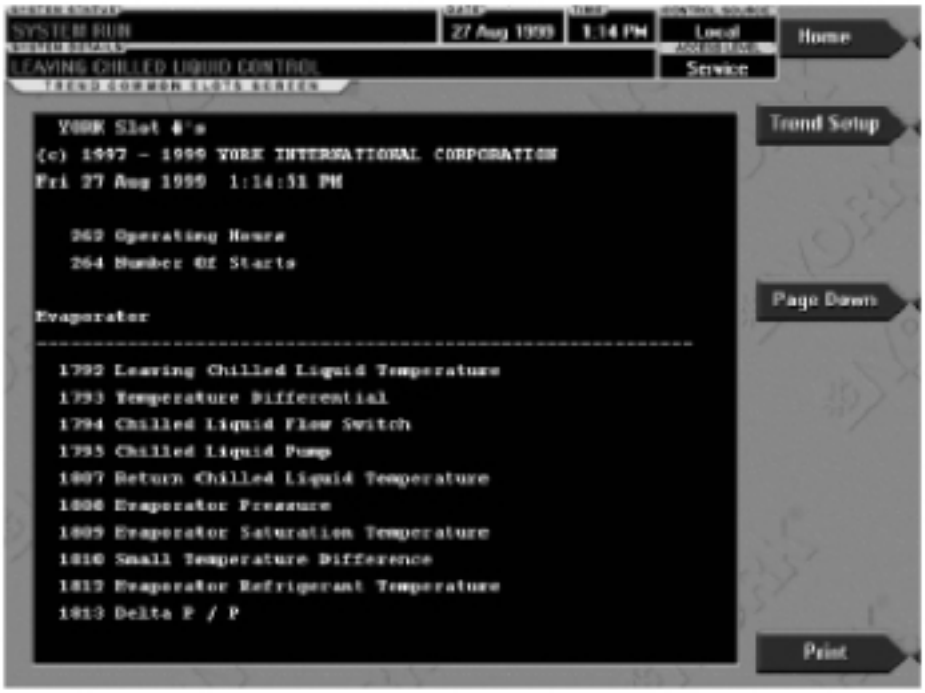
9.1.1 TREND SETUP SCREEN

The Slot Nos (see Section 9.1.2) and Select buttons are used to enter the slot numbers and the minimum and maximum Y-Axis values of each parameter to be trended.

The slot number can be obtained from the Common Slots Screen or Master Slot Number List. Setting this slot number to zero will disable trending for that particular Data Point.

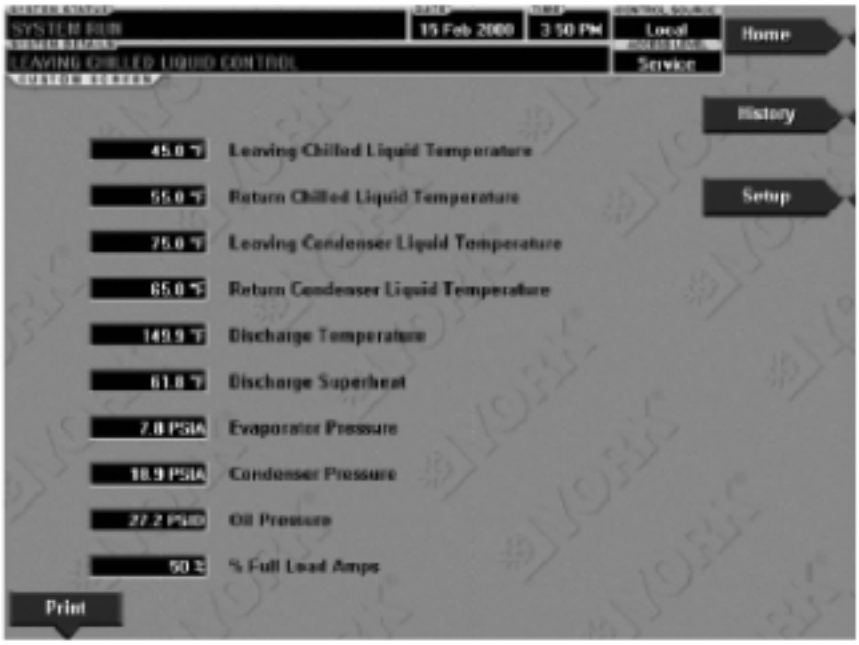
There are 20 Y-Axis divisions between the minimum and maximum values. If a MIN-MAX span is selected that is not evenly divided by 20, the program will automatically select the next higher MAX value that makes the span divisible by 20. The minimum value must always be set to a value less than the maximum value and the minimum value should be set to zero (0) for digital parameters with the maximum value set to one (1).

9.1.2 TREND COMMON SLOTS SCREEN



This screen displays the slot numbers of the commonly monitored parameters.

9.2 CUSTOM SCREEN(Flash Memory Card Version C.MLM.01.04 or later)



This screen allows up to 10 Service Technician selected parameters to be displayed for trouble-shooting. These parameters are selected from a list on the Custom View Setup Screen. At completion of the service call, the display can be cleared or the parameters can be left there for monitoring by operations personnel.

10 DISPLAY MESSAGES

The 'SYSTEM STATUS' and 'SYSTEM DETAILS' are displayed at the top of the graphic display.

The 'SYSTEM STATUS' message describes the operating state of the unit; whether it is stopped, running, starting or shutting down.

The 'SYSTEM DETAILS' displays Warning, Cycling, Safety, Start Inhibit and other messages that provide further details of the 'SYSTEM STATUS' messages.

Messages are displayed in different colours to help identify them:

GREEN - Normal operation messages

YELLOW - Warning messages

ORANGE - Cycling Shutdown messages

RED - Safety Shutdown messages

10.1 SYSTEM STATUS Messages

SYSTEM READY TO START

The unit is shut down but will start upon receipt of a local or remote start signal.

CYCLING SHUTDOWN – AUTO RESTART

The unit is shut down on a 'CYCLING' shutdown. The cause of the shutdown is still in effect and displayed in the 'SYSTEM DETAILS'. The unit will automatically restart when the 'CYCLING' condition clears.

SAFETY SHUTDOWN – MANUAL RESTART

The unit is shut down on a 'SAFETY' shutdown. The cause of the shutdown is still in effect and displayed in the 'SYSTEM DETAILS'. The unit can be started after the 'SAFETY' condition clears and the 'COMPRESSOR' switch has been cycled to the 'STOP-RESET' (O) position.

SYSTEM PRELUBE

A unit start has been initiated and the pre-start lubrication is being performed. The Pre-lube duration is either 50 seconds or 180 seconds. The standard Pre-lube duration is 50 seconds.

The Pre-lube duration is set by the microprocessor board program switch and must never be changed by anyone other than a qualified Service Technician.

SYSTEM RUN

The unit is running under the condition displayed in the 'SYSTEM DETAILS'.

SYSTEM COASTDOWN

The unit has shutdown and the post-run lubrication is being performed. On electric motor drive applications, the post-lube duration is 150 seconds.

The Post-lube duration is set by the microprocessor board program switch and must never be changed by anyone other than a qualified Service Technician.

START INHIBIT

The unit is prevented from being started due to the condition displayed in the 'SYSTEM DETAILS'.

VANES CLOSING BEFORE SHUTDOWN

One of the following shutdowns has been initiated. When the Pre-rotation Vanes (PRV) have fully closed, the unit will shutdown.

- Leaving Chilled Liquid – Low Temperature
- Multi-unit Cycling – Contacts Open
- Control Panel – Schedule
- System cycling – Contacts Open
- Remote Stop

10.2 SYSTEM DETAILS Messages

10.2.1 Run Messages

LEAVING CHILLED LIQUID CONTROL

The unit is running, controlling the leaving chilled liquid to the 'LEAVING CHILLED LIQUID TEMPERATURE SETPOINT'. There are no system conditions inhibiting this operation.

CURRENT PULLDOWN LIMIT

The pulldown demand limit setpoint timer is in effect and the compressor motor current is > the 'PULLDOWN DEMAND CURRENT LIMIT SETPOINT' value. The PRV operation is being inhibited. (Refer to 'MOTOR – HIGH CURRENT LIMIT' message below).

MOTOR – HIGH CURRENT LIMIT

The compressor motor current is > the local or remote 'CURRENT LIMIT SETPOINT'.

The 'CURRENT LIMIT SETPOINT' is programmed over a range of 30 to 100% of the unit Full Load Amps (FLA). When the motor current increases to the 'INHIBIT OPEN' threshold, the PRV are inhibited from further opening. This prevents a further current rise. If the current continues to rise to the 'START CLOSE' threshold, the PRV begin closing until the current falls to the 'STOP CLOSE' threshold. Automatic PRV operation is resumed and this message automatically clears when the motor current decreases to the 'ALLOW OPEN' threshold.

The thresholds are different for the various motor starter applications. To allow field calibration of the CM2 current module and SSS logic board, special thresholds are applied when logged in at SERVICE access level.

An example of current limit is as follows:

- Unit FLA is 100 Amps
- Current Limit Setpoint is 50%

Thresholds:

- 50 Amps – inhibit PRV open
- 52 Amps – PRV begin closing
- 51 Amps – PRV stop closing
- 49 Amps – allow automatic PRV control

10.2.2 Start Inhibit Messages

ANTI-RECYCLE XXMIN/SEC

The unit is inhibited from starting because the 30-minute anti-recycle time has not yet elapsed. Time remaining is displayed.

VANE MOTOR SWITCH OPEN

The unit is inhibited from starting because the PRV are not fully closed.

MOTOR CURRENT >15% FLA

The control panel has detected a compressor motor current of a magnitude that is >15% of the unit 'FULL LOAD AMPS' for 10 continuous seconds, while the unit is shutdown. As long as this condition exists, the oil pump is turned on.

Normally this indicates a failure of the motor starter, control panel start circuits or motor current feedback circuits. After motor current is no longer detected, a 'SYSTEM COASTDOWN' is performed.

The unit can be started after motor current is no longer detected, the 'SYSTEM COASTDOWN' has completed the 'COMPRESSOR' switch has been cycled to the 'STOP-RESET' (O) position.

Models with Mod. 'B' Solid State Starter only
(Liquid Cooled Solid State Starter LCSSS)

LCSSS - HIGH TEMPERATURE PHASE X -STOPPED

The unit is stopped and the LCSSS logic/trigger board has detected that the temperature of phase A, B, or C (designated as X in this message) silicon controlled rectifier (SCR) module is > 43.3 °C (110 °F). The starter cooling pump will run and the unit will be inhibited from starting until the temperature decreases to < 42.8 °C (109 °F).

10.2.3 Warning Messages

WARNING – REAL TIME CLOCK FAILURE

During the power-up initialisation process test data is written to a location in the (BRAM) battery backed memory device (U52 on the microprocessor board). This data is then read from the BRAM and compared to the test data. When a difference occurs, it is assumed the BRAM and real time clock operation is defective and this message is displayed.

The BRAM should be replaced by a qualified Service Technician. This message automatically clears when the BRAM fault has been repaired.

WARNING – CONDENSER OR EVAPORATOR XDCR ERROR

The evaporator pressure transducer is indicating a higher pressure than the condenser pressure transducer after the unit has been running for 10 minutes. This indicates failure of the condenser or evaporator transducer.

This message will be displayed until the condition clears and the 'WARNING RESET' key is pressed in 'OPERATOR' (or higher) access mode.

The transducers are not checked in when the unit is in the BRINE (GLYCOL) mode.

WARNING - REFRIGERANT LEVEL OUT OF RANGE

The output of the condenser refrigerant level sensor is > 5.1 Vdc. This indicates failure of the level sensor.

While this condition exists, the refrigerant variable orifice is driven to the full open position. This message automatically clears when the refrigerant level sensor output is within range.

WARNING – STANDBY LUBE - LOW OIL PRESSURE

A minimum of 103.5 kPa (15 PSID) of differential oil pressure was not achieved in the first 30 seconds of a standby lubrication cycle, or the pressure decreased below this value during the remainder of the cycle.

This message will be displayed and no further standby lubrications will be performed until the 'WARNING RESET' key is pressed in 'OPERATOR' (or higher) access mode.

WARNING – SETPOINT OVERRIDE

A blank BRAM (U52 on the microprocessor board) or a failure of this device was detected during the initialisation process that occurs when power is applied to the control panel.

Due to this failure, any or all of the programmed 'SETPOINTS' could have been corrupted. Therefore, all 'SETPOINTS' have been automatically changed to their default values.

All Setpoints will have to be re-programmed to their desired values.

This message will clear when the 'WARNING RESET' key is pressed in 'OPERATOR' (or higher) access mode.

WARNING – CONDENSER – HIGH PRESSURE LIMIT

The condenser pressure exceeds the programmed 'HIGH PRESSURE WARNING SETPOINT'. While this condition is in effect, the PRV are inhibited from further opening.

This message automatically clears and the PRV are permitted to open when the condenser pressure decreases to 34.5 kPa (5 PSIG) below the 'SETPOINT'.

WARNING – EVAPORATOR – LOW PRESSURE LIMIT

The evaporator pressure has decreased to the 'WARNING THRESHOLD'. This threshold is fixed in 'WATER COOLING' applications (186.2 kPa (27 PSIG). In 'BRINE (GLYCOL) COOLING' applications, the threshold is a fixed amount (13.8 kPa (2 PSIG) above the programmable 'SAFETY SHUTDOWN THRESHOLD'.

The 'SAFETY SHUTDOWN THRESHOLD' in 'BRINE (GLYCOL) COOLING' applications is determined by the brine/glycol solution and is fixed York.

While this condition is in effect, the PRV are inhibited from further opening. This message automatically clears and the PRV are permitted to open when the evaporator pressure increases to the 'RESET' value.

This 'RESET' value is fixed in 'WATER COOLING' applications (193.1 kPa (28 PSIG). In 'BRINE (GLYCOL) COOLING' applications, the 'RESET' value is a fixed amount (20.7 kPa (3 PSIG) above the programmable 'SAFETY SHUTDOWN THRESHOLD'.

Models with Variable Speed Drive (VSD) only

WARNING – VANES UNCALIBRATED – FIXED SPEED

The compressor motor VSD is operating in 'Fixed Speed' (full speed) mode because the PRV position potentiometer calibration has not been performed.

WARNING – HARMONIC FILTER – OPERATION INHIBITED

The compressor motor VSD harmonic filter has been inhibited.

Harmonic filter operation should only be modified by a qualified Service technician. Refer to VSD Service Manual 160.00-M1.

WARNING – HARMONIC FILTER – DATA LOSS

Communications between the harmonic filter logic board and the compressor motor VSD logic board or the Adaptive Capacity Control (ACC) board is not occurring.

While this condition exists, all filter related parameters are displayed as X's. This message automatically clears when communications are restored.

WARNING – HARMONIC FILTER–INPUT FREQUENCY RANGE

The power line frequency detected by the compressor motor VSD harmonic filter is outside the range of 49 to 51 Hz (50 Hz units) or 58 to 62 Hz (60 Hz units).

While this condition exists, all filter related parameters are displayed as X's. This message automatically clears when the line frequency is within range.

Models with Hot Gas By-pass only

WARNING – VANES UNCALIBRATED

The Hot Gas By-pass feature is enabled, but the PRV calibration procedure has not yet been performed.

Models with Analogue I/O Board

WARNING – EXTERNAL I/O – SERIAL COMMUNICATIONS

Serial communications between the microprocessor board and the optional analogue I/O board has been interrupted for at least 20 seconds.

10.2.4 Routine Shutdown Messages

REMOTE STOP

A shutdown command has been received from a remote device. 'REMOTE STOP' commands can be received in 'DIGITAL REMOTE MODE' via I/O board TB4-7/8 or in 'ISN (Integrated Systems Network) REMOTE MODE' via the General Protocol Interface Card (GPIC) serial communications.

If the unit is running when this occurs, the PRV are driven fully closed prior to shutting down the unit.

LOCAL STOP

A local shutdown command has been received by placing the unit 'START-RUN-STOP/RESET' switch in the STOP (O) position.

PLACE COMPRESSOR SWITCH IN RUN POSITION

The control panel is in either 'DIGITAL REMOTE MODE' or 'ISN REMOTE MODE'. The 'OPERATOR' is requested to place the 'COMPRESSOR' switch in the 'RUN' position. The control panel will not accept a remote 'START/STOP' command unless the 'COMPRESSOR' switch is in the 'RUN' position.

10.3 Cycling Shutdown Messages

MULTIUNIT CYCLING – CONTACTS OPEN

The 'MULTIUNIT CYCLING' contacts connected to I/O board TB4-9, have opened to initiate a cycling shutdown.

If the unit is running when this occurs, the PRV are driven fully closed prior to shutting down the unit. The unit will automatically restart when the contacts close.

SYSTEM CYCLING – CONTACTS OPEN

The 'SYSTEM CYCLING' contacts connected to I/O board TB4-13, have opened to initiate a cycling shutdown.

If the unit is running when this occurs, the PRV are driven fully closed prior to shutting down the unit. The unit will automatically restart when the contacts close.

OIL – LOW TEMPERATURE DIFFERENTIAL

The unit is prevented from starting because for one of the following reasons. The unit will automatically restart when the conditions have been satisfied.

- The unit has been shut down for < 30 minutes and the oil temperature minus the condenser saturation temperature is < -1.1 °C (30 °F).

OR

- The unit has been shut down for > 30 minutes and the oil temperature minus the condenser saturation temperature is < 4.4 °C (40 °F).

OR

- Following a Power failure, upon restoration of power, the oil temperature minus the condenser saturation temperature is < 4.4 °C (40 °F).

OIL – LOW TEMPERATURE

The oil temperature has decreased to < 12.8 °C (55 °F). The unit will automatically restart when the temperature increases to > 12.8 °C (55 °F) and is greater than the condenser saturated temperature by -1.1 °C (30 °F) or 4.4 °C (40 °F), refer to 'OIL – LOW TEMPERATURE DIFFERENTIAL' message description above.

CONTROL PANEL – POWER FAILURE

A control power failure has occurred. If the power failure occurred while the unit was running, it will automatically restart when power is restored.

However, if the power failure duration was < the duration of the 'COASTDOWN' period (150 seconds) when power is restored, the remainder of the 'COASTDOWN' will be performed, prior to the unit starting.

This message can indicate a 'CYCLING' in orange characters (auto-restart after power failure) or 'SAFETY' in red characters (manual restart after power failure) shutdown, depending upon control panel configuration.

The control panel is configured for auto-restart or manual restart after power failure by a qualified Service Technician.

LEAVING CHILLED LIQUID – LOW TEMPERATURE

The leaving chilled liquid temperature has decreased to the programmed 'SHUTDOWN TEMPERATURE SETPOINT'. If the unit is running when this occurs, the PRV are driven fully closed prior to shutting down the unit.

The unit will automatically restart when the temperature increases to the programmed 'RESTART TEMPERATURE SETPOINT'.

LEAVING CHILLED LIQUID – FLOW SWITCH OPEN

The chilled liquid flow switch has remained open for 2 seconds while the unit was running or failed to close during the 'SYSTEM PRE-LUBE' period. The unit will automatically restart when the flow switch closes.

CONDENSER – FLOW SWITCH OPEN

The condenser water flow switch has remained open for 2 seconds while the unit was running. This check is by-passed for the first 30 seconds of 'SYSTEM RUN'. The unit will automatically restart when the flow switch closes.

MOTOR CONTROLLER – CONTACTS OPEN

The CM-2 current module (Electromechanical Starter applications) or SSS logic board (Mod 'A' Solid State Starter applications) has shutdown the unit. When detecting a fault condition that places the starter or motor at risk, these devices open the motor controller contacts 'CM' (located on the respective device and connected between TB6-16 and TB6-53 in the control panel) to initiate a shutdown.

Since there are several different faults that are monitored, LED's on the respective device illuminate to identify the specific fault that has occurred.

Refer to manual 160.46-OM3.1 for details of Mod 'A' Solid State Starter shutdowns and manual 160.54-M1 for CM-2 shutdowns.

The unit will automatically restart when the motor controller contacts close. On some shutdowns, the respective device automatically closes the contacts when the fault condition clears. Other shutdowns require the 'OPERATOR' to perform a 'MANUAL RESET' at the respective device.

MOTOR CONTROLLER – LOSS OF CURRENT

The compressor motor current decreased to ≤ 10% Full Load Amps (FLA) for 25 seconds while the unit was running. This could be caused by the starter de-energising during run or a defect in the motor current feedback circuitry to the control panel.

The unit will automatically restart at the completion of 'SYSTEM COASTDOWN'.

POWER FAULT

The CM-2 current module (Electro-mechanical starter applications) or SSS logic board (Mod 'A' Solid State Starter applications) has shutdown the unit because it detected a fault condition that places the motor at risk.

These devices open and close the motor controller 'CM' contacts (located on the respective device and connected between TB6-16 and TB6-53 in the control panel) in < 3 seconds to initiate the shutdown and produce this message. The unit will automatically restart when the contacts close.

An LED on the respective device illuminates to identify the specific fault that has occurred. Refer to manual 160.46-OM3.1 for details of Mod 'A' Solid State Starter shutdowns and manual 160.54-M1 for CM-2 shutdowns.

CONTROL PANEL – SCHEDULE

The programmed 'DAILY SCHEDULE SETPOINT' has shutdown the unit. If this occurs while the unit is running, the PRV are driven fully closed prior to shutting down the unit. The unit will automatically restart at the next scheduled start time.

PROXIMITY PROBE – LOW SUPPLY VOLTAGE

This message indicates that the +12 Vdc power supply voltage to the proximity probe has decreased to < +9.5 Vdc, which is below the minimum level required for reliable probe operation. The unit will automatically restart when the voltage increases to > 10.0 Vdc.

OR

This message indicates the +24 Vdc power supply voltage to the proximity probe has decreased to +19.0 Vdc, which is below the minimum level required for reliable operation. The unit will automatically restart when the voltage increases to >19.7 Vdc.

Models with Variable Speed Oil Pump

OIL – VARIABLE SPEED PUMP – DRIVE CONTACTS OPEN

The Variable Speed Oil Pump (VSOP) has shut down the unit by opening its status contacts connected to the I/O board TB3-70. The VSOP initiates a shutdown anytime its internal protection circuits will not permit the VSOP to run.

The contacts remain open until its internal protection circuits are satisfied it is safe to operate. The unit will automatically restart when the contacts close.

Some VSD initiated shutdowns require AC power to be cycled to clear the fault. Refer to manual 160.54-M1.

10.3.1 Cycling Shutdown Messages Models with MOD 'A' Solid State Starter

STARTER – LOW SUPPLY LINE VOLTAGE

The voltage in any phase of the AC supply to the Solid State Starter (SSS) has decreased to the 'LOW LINE VOLTAGE THRESHOLD' for 20 seconds. The unit will automatically restart when the voltage returns to the 'RESTART' level.

STARTER – HIGH SUPPLY LINE VOLTAGE

The voltage in any phase of the AC supply to the SSS has increased to the 'HIGH LINE VOLTAGE THRESHOLD' for 20 seconds. The unit will automatically restart when the voltage returns to the 'RESTART' level.

SSS - Supply Voltage Thresholds

Supply Voltage Range (V)	Low Supply Voltage		High Supply Voltage	
	Shutdown (V)	Re-start (V)	Shutdown (V)	Re-start (V)
Disabled	None	N/A	None	N/A
380	305	331	415	414
400	320	349	436	435
415	335	362	454	453
440 - 480	370	400	524	523
550 600	460	502	655	654

10.3.2 Cycling Shutdown Messages Models with MOD 'B' Solid State Starter

LCSSS INITIALIZATION FAILED

When AC Power is restored to the system after a power failure, an initialisation process occurs during which the control panel attempts to establish communications through the serial communications link with the LCSSS.

If communications are not established within 10 consecutive attempts, a 'CYCLING SHUTDOWN' is performed and this message is displayed. The control panel will attempt to establish communications until successful.

LCSSS - SERIAL COMMUNICATIONS

After communications have been successfully established in the initialisation process, the control panel initiates a data transmission to the LCSSS on the serial communications link every 2 seconds. After these communications have been established, if the control panel does not receive a reply within 10 consecutive attempts, a 'CYCLING SHUTDOWN' is performed and this message is displayed.

This same 'CYCLING SHUTDOWN' is performed, along with the same message, if the LCSSS does not receive a response from the control panel after 10 consecutive attempts to communicate with the control panel after initialisation has been successfully completed.

The control panel attempts to establish communications until successful.

LCSSS SHUTDOWN - REQUESTING FAULT DATA...

The LCSSS logic/trigger board has shut down the unit but the control panel has not yet received the cause of the fault from the LCSSS, via the serial communications link.

The LCSSS shuts down the unit by opening the motor controller LCSSS stop contacts (K1 relay located on the logic/trigger board and connected between TB6-16 and TB6-53 in the control panel).

The microprocessor board, in the control panel then sends a request for the cause of the fault to the logic/trigger board over the serial communications link.

Since serial communications are initiated every 2 seconds, this message is typically displayed for a few seconds and then replaced with one of the following fault messages.

LCSSS - STOP CONTACTS OPEN

See 'LCSSS SHUTDOWN – REQUESTING FAULT DATA...'.

If the microprocessor board in the control panel does not receive the cause of a starter initiated shutdown within 20 seconds of the shutdown, it is assumed it is not available and that message is replaced with this message. The unit can be started when the Motor Controller LCSSS Stop Contacts close.

A missing interlock jumper between the LCSSS logic/trigger board J1-1 and J1-12 will also produce this message.

LCSSS - POWER FAULT

The LCSSS logic/trigger board has detected that the compressor motor current in one or more phases has decreased to <10% of the motor FLA for a minimum of 1 line cycle.

This check is inhibited during the first 4 seconds of 'SYSTEM RUN' and until the motor current is >25% of the motor FLA. The unit will automatically restart upon completion of 'SYSTEM COASTDOWN'.

LCSSS - LOW PHASE (X) TEMPERATURE SENSOR

The LCSSS logic/trigger board has detected that the temperature of the starter phase A, B or C (designated as X in the message) Silicon Controlled Rectifier (SCR) module has decreased to < 2.8 °C (37 °F). This would generally indicate a disconnected or defective sensor.

If all three SCR modules are indicating a temperature of <2.8 °C (37 °F), the SCR Module cooling pump turns on. This is accomplished by disconnecting all three sensors.

This feature allows Service Technicians to run the cooling pump while filling the cooling system by disconnecting plugs P2, P3 and P4 in the LCSSS.

LCSSS - RUN SIGNAL

The LCSSS receives two start signals from the control panel simultaneously; one via the serial communications link and one via the start relay TB6-24 in the control panel.

If they are not received within 5 seconds of one another, a 'CYCLING SHUTDOWN' is performed and this message is displayed. This generally indicates defective wiring.

LCSSS - INVALID CURRENT SCALE SELECTION

There is an invalid compressor motor current scale jumper combination installed on the LCSSS logic/trigger board J1. The jumper combination determines allowable '100% Motor FLA' .

Setpoint range:

Model	7L	14L	26L	33L
FLA (A)	35 to 260	65 to 510	65 to 510	215 to 1050

The unit will be permitted to start when the jumpers are configured correctly.

Refer to manual 160.00-O2 for valid jumper configurations.

LCSSS - PHASE LOCKED LOOP

The LCSSS logic/trigger board phase locked loop circuit was not able to maintain lock with phase A of the power supply. This could be caused by a power supply fluctuations. A power supply frequency fluctuation of up to 3 Hz/second can be tolerated. The unit will automatically restart when lock has resumed.

LCSSS - LOW SUPPLY LINE VOLTAGE

The LCSSS logic/trigger board has detected that the compressor motor AC power supply, in any phase, decreased below the low voltage threshold for 20 seconds. The unit will automatically restart when the voltage in all phases returns to the restart level.

LCSSS - HIGH SUPPLY LINE VOLTAGE

The LCSSS logic/trigger board has detected that the compressor motor AC power supply, in any phase, exceeded the high voltage threshold for 20 seconds. The unit will automatically restart when the voltage in all phases returns to the restart level.

LCSSS Supply Voltage Thresholds

Supply Voltage Range (V)	Low Supply Voltage Shutdown (V)	Low Supply Voltage Re-start (V)	High Supply Voltage Shutdown (V)	High Supply Voltage Re-start (V)
Disabled	None	N/A	None	N/A
200 - 208	160	174	227	226
220 - 240	185	200	262	261
380	305	331	415	414
400	320	349	436	435
415	335	362	454	453
440 - 480	370	400	524	523
550 600	460	502	655	654

LCSSS - LOGIC BOARD PROCESSOR

Communication between the V25 Microprocessor and Digital Signal Processor (DSP) on the LCSSS logic/trigger board has been interrupted. The unit will automatically restart when communications are restored.

LCSSS - LOGIC BOARD POWER SUPPLY

Following application of power, this message is displayed and a snapshot of the LCSSS parameters and time of power failure are sent to the control panel.

LCSSS – PHASE ROTATION/LOSS

(Flash Memory Card Version C.MLM.01.03 or earlier)

The LCSSS logic/trigger board has detected the three-phase compressor motor supply voltage phase rotation is not correct or the line-to-line voltage in any phase has decreased to <30% of nominal. The unit will automatically restart when the power line conditions are acceptable.

LCSSS - PHASE LOSS

(Flash Memory Card Version C.MLM.01.04 or later)

The LCSSS logic/trigger board has detected the line-to-line RMS voltage in any phase has decreased to < 30% of the lowest value of the programmed voltage range.

If the programmed voltage range is 'DISABLED', a value of 60 Vac is used as the threshold. The unit will automatically restart when the line voltage is > the 'SHUTDOWN THRESHOLD'.

10.3.3 Cycling Shutdown Messages Models with Variable Speed Drive

These messages are generated by events that occur within the Variable Speed Drive (VSD). The unit will automatically restart when the cycling condition clears.

Service and troubleshooting information is contained in manual 160.00-M1.

VSD SHUTDOWN – REQUESTING FAULT DATA

The VSD has shutdown the unit and the control panel has not yet received the cause of the fault from the VSD, via the serial communications link. The VSD shuts down the unit by opening the motor controller VSD stop contacts (located on the VSD logic board and connected between TB6-16 and TB6-53 in the control panel).

The microprocessor board in the control panel then sends a request for the cause of the fault to the VSD logic board via the Adaptive Capacity Control (ACC) board, over the serial link. Since serial communications are initiated every 2 seconds, this message is typically displayed for a few seconds and then replaced with one of the following fault messages:

VSD – STOP CONTACTS OPEN

See 'VSD SHUTDOWN – REQUESTING FAULT DATA'.

If the microprocessor board in the control panel does not receive the cause of the fault over the serial link within 20 seconds, it is assumed it is not available and that message is replaced with this message.

VSD INITIALIZATION FAILED

Upon application of power, all boards go through the initialisation process. At this time, memory locations are cleared, program jumper positions are checked and serial communications links are established. There are several causes for an unsuccessful initialisation as follows:

- The control panel and the VSD must be energised at the same time. The practice of pulling the fuse in the control panel to remove power from the control panel will create a problem. Power-up must be accomplished by closing the switch disconnect on the VSD cabinet with all fuses in place. A power interruption to the VSD logic board will also generate this message.

- The EPROM's must be of the correct version for each VSD board and they must be installed correctly. The EPROM's are created as a set, and cannot be interchanged between earlier and later versions.

- Serial data communications must be established. Refer to 'VSD - SERIAL COMMUNICATIONS FAULT'. If communications between the VSD logic board, harmonic filter logic board, ACC board and control panel microprocessor board does not take place during initialisation, this message will be generated.

  The serial communications can be verified by selecting the 'VSD DETAILS' screen from the 'MOTOR' screen and observing the full load amps value. A zero displayed for this and other VSD parameters indicates a serial communications link problem.

- If the harmonic filter option is included, make sure the filter logic board is not in continuous reset. This condition is indicated by the filter logic board's LED's alternately blinking. The filter can be eliminated as a cause of initialisation failure by disconnecting the filter by placing switch SW1 on the filter logic board in the OFF position and removing the ribbon cable between the filter logic board and the VSD logic boards.

- VSD and harmonic filter horsepower ratings do not agree.

VSD – HIGH PHASE X INSTANTANEOUS CURRENT

This shutdown is generated by the VSD if the motor current in phase 'A, B or C' (designated as X in the message) exceeds a given limit. The motor current is sensed by the current transformers on the VSD output pole assemblies and the signals are sent to the VSD logic board for processing. Maximum instantaneous permissible currents are:

Model	Current (A)
351/292 HP	771
503/419 HP	1200
790/658 HP	1890

If an over-current trip occurs, but the unit restarts and runs without a problem, the cause may be attributed to a voltage fluctuation on the power supply feeding the VSD that is in excess of the specified voltage range for this product.

This is most likely if the unit was running at, or near full load. If there should be a sudden dip in supply voltage, the current to the motor will increase, since the motor wants to draw constant horsepower. The unit PRV cannot close quickly enough to correct for this sudden increase in current, and the unit will trip on an over-current fault.

If the unit will not re-start, but keeps tripping on this same shutdown, an output pole problem is the most likely cause. The VSD will require service under these conditions.

VSD – PHASE X GATE DRIVER

A second level of current protection exists on the VSD driver boards themselves in phase 'A, B or C' (designated as X in the message). The collector-to-emitter saturation voltage of each IGBT is checked continuously while the device is gated on. If the voltage across the IGBT is greater than a set threshold, the IGBT is gated off and a shutdown pulse is sent to the VSD logic board shutting down the entire VSD system. A gate driver fault can be initiated when the VSD is not running.

VSD - SINGLE PHASE INPUT POWER

This shutdown is generated by the SCR trigger control and relayed to the VSD logic board to initiate a system shutdown. The SCR trigger control uses circuitry to detect the loss of any one of the three input phases. The trigger will detect the loss of a phase within one half line cycle of the phase loss. This message is also displayed every time power to the VSD is removed or if the input power dips to a very low level.

VSD – HIGH DC BUS VOLTAGE

The VSD's DC link voltage is continuously monitored and if the level exceeds 745 Vdc, a bus over-voltage shutdown is initiated. If this shutdown occurs, it will be necessary to check the level of the 460 Vac applied to the drive. The specified voltage range is 414 to 508 Vac. If the incoming voltage is in excess of 508 Vac, the voltage should be reduced to within the specified limits.

VSD – LOGIC BOARD POWER SUPPLY

This shutdown is generated by the VSD logic board and it indicates that the low voltage power supplies for the logic boards have dropped below their allowable operating limits. The power supplies for the logic boards are derived from the secondary of the 120 to 24 Vac transformer, which in turn, is derived from the 480 to 120 Vac control power transformer. This message usually means the power to the VSD has been removed.

VSD – LOW DC BUS VOLTAGE

If the DC link drops below 414 Vdc (or 500 Vdc for 60 Hz applications), the drive will initiate a system shutdown. A common cause for this shutdown is a severe dip in the incoming power to the drive. Monitor the incoming three-phase AC supply for severe dips and also monitor the DC link with a voltmeter.

VSD – DC BUS VOLTAGE IMBALANCE

The DC link is filtered by a number of large electrolytic capacitors, rated for 450 Vdc. These capacitors are wired in series to achieve 900 Vdc capability for the DC link. It is important that the voltage be shared equally from the junction of the centre, or series capacitor connection, to the negative bus and the positive bus. This centre point should be approximately ½ of the total DC link voltage. Most actual bus voltage imbalance conditions are caused by a shorted capacitor or a leaky or shorted IGBT transistor in an output phase bank assembly. This usually indicates the VSD requires service.

VSD – PRECHARGE – DC BUS VOLTAGE IMBALANCE

This message indicates the same as the 'VSD-DC BUS VOLTAGE IMBALANCE' message above, except the condition occurred during the Pre-lube period.

VSD – HIGH INTERNAL AMBIENT TEMPERATURE

The ambient temperature monitored is actually the temperature detected by a component mounted on the VSD logic board. The high ambient trip threshold is set for 60 °C (140 °F). Some potential causes for this shutdown are:

- internal VSD fan failure
- VSD water pump failure
- entering condenser water temperature exceeds limits

Additional causes for the shutdown are:

- Blocked Strainer – The standard strainer contains a woven mesh element with 20 stainless steel wires per inch. This has been found to work adequately on most applications. Some areas may have very dirty condenser water, which can cause the strainer to block. Locations with special conditions may want to consider a dual strainer arrangement with isolating valves, to permit cleaning of one strainer with the unit still on line.
- Blocked Heat Exchanger – In cases where the strainer blocks frequently, the heat exchanger may eventually block or become restricted to the point of reduced flow. At this point, we suggest you back-flush the heat exchanger by reversing the two rubber hoses that supply condenser water to-from the heat exchanger. If the rust cannot be back-flushed, the heat exchanger might have to be replaced.
- Low Condenser Flow – The VSD system requires 8 feet of pressure drop across the heat exchanger to maintain adequate flow. If the pressure drop is less than 8 feet, it will be necessary to correct the flow problem or add a booster pump as required.

VSD – INVALID CURRENT SCALE SELECTION

The same VSD logic board is used on all horsepower sizes, the position of Program Jumpers tells the logic board the size of the VSD employed. This allows the VSD to properly scale the output current. If the Jumper configuration is invalid, a shutdown is performed and this message is generated.

VSD – LOW PHASE X INVERTER HEATSINK TEMPERATURE

A heatsink temperature sensor indicating a temperature < 2.8 °C (37 °F) in phase 'A, B or C' (designated as X in the message) will cause the unit to shut down and display this message. In most cases, the problem will be an open thermistor or broken wiring to the thermistor. The normal thermistor resistance is 10K ohms at 21.1 °C (70 °F).

VSD – LOW CONVERTER HEATSINK TEMPERATURE

Refer to 'LOW PHASE A INVERTER HEATSINK TEMPERATURE' message.

VSD – PRECHARGE – LOW DC BUS VOLTAGE

During Pre-charge, the DC link must be equal to or greater than 41 Vdc (50 Vdc for 60 Hz) within ½ second after the Pre-charge relay is energised. If this condition is not met, a shutdown is performed and this message is generated.

VSD – LOGIC BOARD PROCESSOR

This shutdown is generated if a communications problem occurs between the two microprocessors on the VSD logic board.

VSD – RUN SIGNAL

Redundant 'RUN' signals are generated by the control panel; one via TB6-24 and the second via the serial communications link. Upon receipt of either of the two 'RUN' commands by the VSD, a 5 second timer shall commence timing. If both run commands are not received by the VSD logic board within 5 seconds, a shutdown is performed and this message is displayed. This generally indicates a wiring problem between the control panel and the VSD.

VSD – SERIAL COMMUNICATIONS

This message is generated when communications between the ACC board and the VSD logic board, or between the control panel microprocessor board and the VSD logic board, is disrupted. This generally indicates defective wiring between J11 on the VSD logic board and J8 on the ACC board.

HARMONIC FILTER – LOGIC BOARD OR COMMUNICATIONS

This message is generated when communications between the harmonic filter and the VSD logic board, is disrupted. This generally indicates defective wiring between the VSD logic board and the harmonic filter logic board or a defective harmonic filter logic board.

HARMONIC FILTER – HIGH DC BUS VOLTAGE

The harmonic filter's DC Link voltage is continuously monitored and if the level exceeds 860 Vdc, this shutdown is performed.

The harmonic filter has its own DC bus as part of the filter power assembly, this DC Link is independent from the VSD DC link. If this shutdown occurs, it will be necessary to look at the level of 460 Vac supplied to the harmonic filter. The specified voltage range is 414 to 508. If the incoming voltage is in excess of 508, it should be reduced to within specified limits.

HARMONIC FILTER – HIGH PHASE X CURRENT

The maximum instantaneous harmonic filter current in phase 'A, B or C' (designated as X in the message) is monitored and compared to a pre-set limit. If this limit is exceeded, a shutdown is performed and this message is generated. The filter current is monitored using two DC current transformers and these signals are processed by the filter logic board. The pre-set limits are as follows:

Model	Current (A)
351/292 HP	356
503/419 HP	496
790/658 HP	745

If the VSD automatically restarts after this shutdown and continues to operate properly with the filter operating, it is likely the filter tripped due to fluctuations in the voltage feeding the VSD. If this message re-occurs, preventing the unit from starting, the VSD will require service.

HARMONIC FILTER – PHASE LOCKED LOOP

This shutdown indicates that a circuit called 'Phase Locked Loop' on the filter logic board has lost synchronisation with the incoming power supply. This is usually indicates an open fuse in one of the filter's incoming supplies. Filter fuses 11FU, 12FU and 13FU should be checked.

HARMONIC FILTER–PRECHARGE–LOW DC BUS VOLTAGE

During pre-charge, the filter's DC link must be equal to or greater than 41 Vdc (50 Vdc for 60 Hz) within 1/10 second after the pre-charge relay is energised. If this condition is not met, a shutdown is performed and this message is generated.

HARMONIC FILTER – LOW DC BUS VOLTAGE

The harmonic filter generates its own filter DC link voltage by switching its IGBT's. This DC level is higher than what could be obtained by rectifying the input voltage. Therefore, the harmonic filter performs a voltage 'boost' function. This is necessary in order to permit current to flow into the power line from the filter when the input line is at its peak level.

This shutdown occurs when the filter's DC link voltage decreases to a level less than 60 Vdc below the filter DC link voltage setpoint. This setpoint is determined by the filter logic board via the sensing of the three phase input line-to-line voltage. This setpoint is set to the peak of the sensed input line-to-line voltage plus 32 volts, not to exceed 760 volts and it varies with the input line-to-line voltage. If this shutdown occurs occasionally, the likely cause is a severe dip in the input line voltage.

HARMONIC FILTER – DC BUS VOLTAGE IMBALANCE

The filter DC link is filtered by large, electrolytic capacitors, rated for 450 Vdc. These capacitors are wired in series to achieve a 900 Vdc capability for the DC link. It is important the voltage is shared equally from the junction of the centre or series capacitor connection, to the negative bus and to the positive bus. This centre point should be approximately ½ of the total DC link voltage.

HARMONIC FILTER – 110% INPUT CURRENT OVERLOAD

The three phases of RMS filter current are monitored and if any one of the three phases continuously exceeds a given threshold for 7 seconds, a unit shutdown is performed and this message is displayed. The maximum permissible continuous RMS current ratings for the harmonic filter are:

Model	Current (A)
351/292 HP	128
503/419 HP	176
790/658 HP	277

HARMONIC FILTER – LOGIC BOARD POWER SUPPLY

The low voltage power supplies on the filter logic board have decreased below their permissible operating range. The filter logic board receives its power from the VSD logic board via the ribbon cable, connecting the two boards.

HARMONIC FILTER – RUN SIGNAL

When a digital run command is received at the filter logic board from the VSD logic board via the 16 position ribbon cable, a 1/10-second timer is started. If a redundant run command does not occur on the serial data link from the VSD logic board before the timer expires, a shutdown is performed and this message is generated.

HARMONIC FILTER – DC CURRENT TRANSFORMER 1

During initialisation, with no current flowing through the DC current transformers (DCCT's), the DCCT output voltages are measured and compared with a pre-set limit via the filter logic board. If the measured values exceed the precept limits, the DCCT's are presumed to be defective and this shutdown is generated.

HARMONIC FILTER – DC CURRENT TRANSFORMER 2

See 'HARMONIC FILTER – DC CURRENT TRANSFORMER 1' message.

10.4 Safety Shutdown Messages

EVAPORATOR – LOW PRESSURE

The evaporator pressure, as sensed by the evaporator transducer, has decreased to the 'SAFETY SHUTDOWN THRESHOLD'. For water cooling applications, the 'SAFETY SHUTDOWN THRESHOLD' is a fixed value. For Brine/Glycol cooling applications, the 'SAFETY SHUTDOWN THRESHOLD' varies according to the concentration of the Brine/Glycol solution.

The Brine/Glycol 'SAFETY SHUTDOWN THRESHOLD' should only be changed by a qualified Service Technician using manual 160.54- M1.

The unit can be started after the evaporator pressure increases to the restart threshold and the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

EVAPORATOR – LOW PRESSURE - SMART FREEZE

(Flash memory card version C.MLM.01.02 or later)

Smart Freeze protection is activated and has shutdown the unit because the evaporator temperature has been below the 'SMART FREEZE THRESHOLD' for greater than the allowable number of seconds.

If the evaporator refrigerant temperature sensor RT7 is enabled, (see manual 160.54-M1), this parameter is used as the evaporator refrigerant temperature and the freeze threshold is 0.5 °C (32.8 °F).

If RT7 is not enabled, the evaporator refrigerant temperature used is the evaporator saturation temperature, derived from the evaporator pressure transducer and the freeze threshold is 1.1 °C (34 °F).

The total count is incremented once for every second the evaporator refrigerant temperature is below the freeze threshold (but is never decremented below zero). The number of seconds it will take the chilled liquid to freeze is based on how far the evaporator refrigerant temperature is below the freeze threshold.

Smart Freeze is active when enabled by a Service Technician (using manual 160.54-M1) and the 'LEAVING CHILLED LIQUID TEMPERATURE SETPOINT' is < 3.3 °C (38 °F).

EVAPORATOR – TRANSDUCER OR LEAVING LIQUID PROBE

A possible defective evaporator pressure transducer or leaving chilled liquid temperature thermistor has been detected. The pressure and temperature that these devices are indicating are not in the correct relationship to each other.

The control panel converts the evaporator pressure to a saturated temperature value and compares this value to the leaving chilled liquid temperature (difference = chilled liquid temperature – evaporator saturated temperature). The difference should not be outside the range of -19.3 °C (-2.5 °F) to -3.9 °C (+25 °F).

If the transducer and thermistor are accurate, the evaporator saturated temperature should not be > 1.4 °C (2.5 °F) warmer nor > 13.9 °C (25 °F) colder than the leaving chilled liquid temperature. In order to initiate a shutdown, the difference must be outside the acceptable range for 10 minutes.

The unit can be restarted by cycling the 'COMPRESSOR' switch to the 'STOP-RESET' (O) position.

EVAPORATOR – TRANSDUCER OR TEMPERATURE SENSOR

A possible defective evaporator pressure transducer or refrigerant temperature sensor has been detected. The control panel converts the evaporator pressure to a saturated temperature value and compares this value to the optional evaporator refrigerant temperature sensor. If the difference between these temperatures is greater than 1.7 °C (3 °F), for 1 minute, this shutdown is performed.

This check is not performed until the unit has been running for at least 10 minutes. It is also not performed in Brine/Glycol mode (Flash memory card version C.MLM.01.02 or later).

The unit can be restarted after the temperatures are within 1.7 °C (3 °F) of one another and the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

CONDENSER – HIGH PRESSURE CONTACTS OPEN

The contacts of the electro-mechanical high pressure safety device, located on the condenser shell, have opened because this device has detected a pressure > 1241 kPa (180 PSIG). The contacts will automatically close when the condenser pressure decreases to < 827.5 kPa (120 PSIG).

The unit can be restarted after the contacts close and the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

CONDENSER – HIGH PRESSURE

The condenser pressure, as sensed by the condenser transducer, has increased to >1241 kPa (180 PSIG). The unit can be restarted after the pressure decreases to < 827.5 kPa (120 PSIG) and the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

CONDENSER – PRESSURE TRANSDUCER OUT OF RANGE

The condenser pressure transducer is indicating a pressure that is < 47 kPa (6.8 PSIG) or > 2068.5 (300 PSIG). This is outside the normal operating range of the transducer. This generally indicates a defective transducer.

The unit can be restarted after the transducer is indicating a pressure that is within range and the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

AUXILIARY SAFETY – CONTACTS CLOSED

The 'AUXILIARY SAFETY SHUTDOWN' contacts, connected to I/O board TB4-31 have closed, initiating a safety shutdown. This input is a general purpose, user defined safety shutdown input. The unit can be started after the contacts open and the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

DISCHARGE – HIGH TEMPERATURE

The discharge temperature sensed by the discharge temperature thermistor has increased to > 104.4 °C (220 °F). The unit can be restarted after the temperature decreases to < 104.4 °C (220 °F) and the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

DISCHARGE – LOW TEMPERATURE

The discharge temperature sensed by the discharge temperature thermistor has decreased to < -1.1 °C (30 °F). The unit can be restarted after the temperature increases to > -1.1 °C (30 °F) and the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

OIL – HIGH TEMPERATURE

The oil temperature sensed by the oil temperature thermistor has increased to > 82.2 °C (180 °F). The unit can be restarted after the temperature decreases to < 82.2 °C (180 °F) and the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

OIL – LOW DIFFERENTIAL PRESSURE

The differential oil pressure decreased to < 103.5 kPa (15 PSID) while the unit was running or failed to achieve 172.5 kPa (25 PSID) by the last 5 seconds of the 'System Pre-lube' period. The differential oil pressure is the difference between the output of the sump oil pressure transducer (system low pressure) and the output of the pump oil pressure transducer (system high pressure). The unit can be restarted after the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

OIL - HIGH DIFFERENTIAL PRESSURE

The differential oil pressure increased to > 620.5 kPa (90 PSID) while the oil pump was running. The differential oil pressure is the difference between the output of the sump oil pressure transducer (system low pressure) and the output of the pump oil pressure transducer (system high pressure). The unit can be restarted after the differential oil pressure decreases to < 620.5 kPa (90 PSID) and the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

OIL – PUMP PRESSURE TRANSDUCER OUT OF RANGE

The pump oil pressure transducer (system high pressure) is indicating a pressure that is < 0 kPa (0 PSIG) or > 2172 kPa (315 PSIG). This is outside the normal operating range of the transducer. This generally indicates a defective transducer. The unit can be restarted after the transducer is indicating a pressure that is within range and the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

OIL – SUMP PRESSURE TRANSDUCER OUT OF RANGE

The sump oil pressure transducer (system low pressure) is indicating a pressure that is < 0 kPa (0 PSIG) or > 2172 kPa (315 PSIG). This is outside the normal operating range of the transducer. This generally indicates a defective transducer. The unit can be started after the transducer is indicating a pressure that is within range and the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

OIL - DIFFERENTIAL PRESSURE CALIBRATION

The sump and pump oil pressure transducers indicated a differential oil pressure of > 103.5 kPa (15 PSID) during the oil pressure transducer Auto-Zeroing period that begins 10 seconds into 'System Pre-lube' and lasts for 3 seconds. This indicates a defective sump or pump transducer, since the oil pump is not running during this period and the actual differential oil pressure is 0 kPa (0 PSID). The transducers are sensing the same pressure during this period and their outputs should be similar. The unit can be restarted after the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

Models with Variable Speed Oil Pump

OIL – VARIABLE SPEED PUMP – SETPOINT NOT ACHIEVED

One of the following conditions have occurred while in 'System Pre-lube', 'System Run' or 'System Coastdown'. The unit can be restarted after the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

- The differential oil pressure was < 214.3 KPa (35 PSID) for 5 seconds during the last 10 seconds of the 'System Pre-lube' period or during the first 15 seconds of 'System Run'.

OR

- Anytime after the first 30 seconds of 'System run', the differential oil pressure was < the 'OIL PRESSURE SETPOINT' with the speed command from the microprocessor board at 60 Hz for 5 seconds.

CONTROL PANEL – POWER FAILURE

A control power failure has occurred. If the power failure duration was < the duration of the applicable 'Coastdown' period (150 seconds), the remainder of the 'Coastdown' is performed upon restoration of power. The unit can be restarted after the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

This message can indicate a 'CYCLING' in orange characters (auto-restart after power failure) or 'SAFETY' in red characters (manual restart after power failure) shutdown, depending upon control panel configuration.

The control panel is configured for auto-restart or manual restart after power failure by a qualified Service Technician.

Models with Mod 'A' Solid State Starter only

MOTOR OR STARTER – CURRENT IMBALANCE

While the unit was loaded to > 80% Full Load Amps (FLA), the motor current in phase A, B or C was > or < 30% of the average of all three phase currents for 45 seconds. This condition is not checked for the first 45 seconds of 'System Run'.

To allow the unit to run in abnormal conditions, this check can be disabled by a qualified Service Technician using manual 160.54-M1.

Thrust Bearing Safety Shutdown Messages

These shutdowns must be investigated by a qualified Service Technician prior to restarting the unit, to avoid severe compressor damage.

Restart is inhibited until the clearance/value is within acceptable limits and the reset procedure has been performed by the Service Technician, see manual 160.54-M1.

THRUST BEARING – PROXIMITY PROBE CLEARANCE

The clearance between the compressor high speed thrust collar and the tip of the proximity probe has increased > +10 mils or decreased > -25 mils (for 2 continuous seconds) from the reference position. The minimum allowed clearance is 23 mils. Therefore, if the reference position is < 47 mils, the shutdown will occur when the actual clearance is < 22 mils.

THRUST BEARING – PROXIMITY PROBE OUT OF RANGE

The clearance between the compressor high speed thrust collar and the tip of the proximity probe has decreased to < 17 mils.

THRUST BEARING – HIGH OIL TEMPERATURE

(Not applicable to units equipped with Flash Memory Card version C.MLM.01.03 and higher)

The temperature of the oil in the high speed drain line sensed by the proximity probe, has increased to > 121 °C (250 °F).

THRUST BEARING – OIL TEMPERATURE SENSOR

(Not applicable to units equipped with Flash Memory Card version C.MLM.01.03 and higher)

The temperature of the oil in the high speed drain line sensed by the proximity probe, has decreased to < 10 °C (50 °F) during 'System Run' or the last 10 seconds of 'System Pre-lube'.

WATCHDOG – SOFTWARE REBOOT

The microprocessor board's software Watchdog initiated a microprocessor reset because it detected that a part of the unit operating program was not being executed.

The result of this reset is a 'SAFETY SHUTDOWN' and re-initialisation of the program. This generally indicates a severe power disturbance or impending microprocessor board failure. The unit can be restarted after the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

10.4.1 Safety Shutdown Messages Models with MOD 'B' Solid State Starter

LCSSS SHUTDOWN - REQUESTING FAULT DATA

The LCSSS logic/trigger board has shutdown the unit but the control panel has not yet received the cause of the fault from the LCSSS, via the serial communications link.

The LCSSS shuts down the unit by opening the motor controller LCSSS stop contacts (K1 relay located on the logic/trigger board and connected between TB6-16 and TB6-53 in the control panel). The microprocessor board, in the control panel, then sends a request for the cause of the fault to the logic/trigger board over the serial communications link. Since serial communications are initiated every 2 seconds, this message is typically displayed for a few seconds and then replaced with one of the following fault messages.

LCSSS - HIGH INSTANTANEOUS CURRENT

The LCSSS logic/trigger board detected that the compressor motor current in any phase exceeded 1.1(1.414 x RMS value of the programmed start current) for a minimum of 1 second. The unit can be started after the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

LCSSS - HIGH PHASE (X) HEATSINK TEMPERATURE-RUNNING

The LCSSS logic/trigger board has detected the temperature of phase A, B or C (designed as X in the message) SCR modules has exceeded 100 °C (212 °F) while the unit was running. The safety can be reset after all SCR temperatures are < 100 °C (212 °F) and the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

The unit cannot be started until all SCR temperatures are < 42.8 °C (109 °F). During the shutdown, the starter cooling pump runs until the temperature is < 42.8 °C (109 °F).

LCSSS - 105% MOTOR CURRENT OVERLOAD

The highest phase of the compressor motor current increased to > 105% of the programmed 100% unit Full Load Amps for 40 seconds. The unit can be started after the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

LCSSS - MOTOR OR STARTER - CURRENT IMBALANCE

The LCSSS logic/trigger board detected that the three phase compressor motor current imbalance was > 30% for 45 seconds.

The imbalance is not checked until the unit has been running for at least 45 seconds and the average of the three phases of motor current is > 80% of the programmed 100% unit Full Load Amps.

The average is calculated as:

$$Iave = \frac{(Ia+Ib+Ic)}{3}$$

The imbalance is calculated as:

$$\frac{(Ia-Iave) + (Ib-Iave) + (Ic-Iave)}{2(Iave)} \times 100$$

LCSSS - PHASE (X) SHORTED SCR

(Flash memory Card version C.MLM.01.04 or later)

A shorted SCR in phase A, B or C (designated as X in the message) has been detected by the LCSSS logic/trigger board. The voltage across each SCR in monitored to detect the shorted condition. The shorted condition must exist for 5 seconds in order to annunciate the fault.

This check is disabled while the unit is running. The unit can be started after the condition has been corrected and the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

LCSSS - OPEN SCR

An open SCR has been detected by the LCSSS logic/trigger board. The open condition must exist for 5 seconds in order to annunciate the fault. The unit can be started after the condition has been corrected and the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

This check is disabled when the unit is shut down.

In certain applications, local power supply conditions could interfere with the open SCR detection technique. The check should be disabled by a qualified Service Technician using manual 160.54-M1.

LCSSS - PHASE ROTATION

(Flash memory Card version C.MLM.01.04 or later)

The LCSSS logic/trigger board has detected the three phase compressor motor supply voltage phase rotation is not correct. The unit can be restarted when the phase rotation is correct and the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

10.4.2 Safety Shutdown Messages Models with Compressor Motor Variable Speed Drive

These messages are generated by events that occur within the Variable Speed Drive (VSD). The unit can be started after manual resets are performed as detailed below.

Service and troubleshooting information is contained in manual 160.00-M1.

VSD SHUTDOWN – REQUESTING FAULT DATA

The VSD has shut down the unit and the control panel has not yet received the cause of the fault from the VSD, via the serial communications link. The VSD shuts down the unit by opening the motor controller 'VSD Stop Contacts' (located on the VSD logic board and connected between TB6-16 and TB6-53 in the control panel).

The microprocessor board in the control panel then sends a request for the cause of the fault to the VSD logic board via the Adaptive Capacity Control (ACC) board, over the serial link. Since serial communications are initiated every 2 seconds, this message is typically displayed for a few seconds and then replaced with one of the following fault messages.

VSD – STOP CONTACTS OPEN

SEE 'VSD SHUTDOWN – REQUESTING FAULT DATA'

If the microprocessor board in the control panel does not receive the cause of the fault over the serial link within 20 seconds, it is assumed it is not available and that message is replaced with this message.

VSD – 105% MOTOR CURRENT OVERLOAD

This shutdown is generated by the VSD logic board and it indicates that a motor overload has occurred. The shutdown is generated when the VSD logic board has detected that at least 1 of the 3 output phase currents has exceeded 105% of the unit Full Load Amps (FLA) value for > 7 seconds.

The unit FLA value is set by adjustment of the FLA potentiometer on the VSD logic board. The unit can be started after the 'RESET' push-button on the VSD logic board is pressed and the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

VSD – HIGH PHASE X INVERTER HEATSINK TEMPERATURE

This shutdown will occur if the heatsink temperature on phase A, B or C (designated as X in the message) exceeds 70 °C (158 °F) on any of the output pole assemblies. This shutdown will seldom occur. In most cases where the coolant temperature has risen abnormally, the VSD will shut down on 'Ambient Temperature' at 60 °C (140 °F) before the heatsinks can reach 70 °C (158 °F).

If this message is displayed, make sure there is adequate coolant level, ascertain the pump is operating when the unit is running, and check the strainer in the primary of the heat exchanger for blockages and silt.

The unit can be started after the fault condition clears, the 'RESET' button on the VSD logic board is pressed and the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

VSD – HIGH CONVERTER HEATSINK TEMPERATURE

See 'HIGH PHASE X INVERTER HEATSINK TEMPERATURE' message.

VSD – PRECHARGE LOCKOUT

If the VSD fails to make Pre-charge, the Pre-charge relay shall drop out for 10 seconds during which time the VSD's fans and water pumps shall remain energised in order to permit the Pre-charge resistors to cool.

Following this 10 second cool down period, Pre-charge shall again be initiated. The VSD shall attempt to make Pre-charge 3 consecutive times. If the VSD fails to make Pre-charge on 3 consecutive tries, the unit will shut down, lockout and display this message.

The unit can be restarted after the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

HARMONIC FILTER – HIGH HEATSINK TEMPERATURE

The harmonic filter power assembly has one heatsink thermistor on the 351 and 503 HP units, and two heatsink thermistors on the 790 HP units. If the temperature on any heatsink exceeds 75 °C (167 °F), the unit will shut down.

This message is usually an indication of a low coolant level in the VSD cooling loop. The unit can be started after the fault condition clears, the 'OVERTEMP RESET' button on the filter logic board is pressed and the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

HARMONIC FILTER – HIGH TOTAL DEMAND DISTORTION

This shutdown indicates the filter is not operating correctly and the input current to the VSD filter is not sinusoidal. This shutdown will occur if the total demand distortion (TDD) exceeds 25% for 45 seconds.

TDD is the 'total root-sum-square harmonic current distortion, in percent of the maximum demand load current (15 or 30 min demand)'.

In the York supplied filter option the displayed TDD is the total RMS value of all the harmonic current supplied by the main power to the VSD divided by the unit Full Load Amps, in percent. A standard VSD, less the optional filter typically has an input current TDD level on the order of 28-30%.

The unit can be started after the 'COMPRESSOR' switch is cycled to the 'STOP-RESET' (O) position.

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